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ABSTRACT

The aim of this study was to delineate departmental differences in the length of time that doctoral students take to receive their degrees and the institutional characteristics linked with it, being as comprehensive as possible in the institutional characteristics examined and disentangling the confounding effects of student characteristics. Variables describing graduate departments in three disciplines and their parent universities were obtained from 86 departments of Chemistry, 57 departments of English, and 62 departments of Psychology. In analyses of departments in each discipline, a relatively small set of institutional variables correlated with average time to the doctorate for each department, after controlling for characteristics of students in the department, and these relationships differed from discipline to discipline. The clearest and most extensive findings emerged for Psychology: the institutional variables identified primarily concerned faculty accessibility (student/faculty ratio and department size), with longer time required in departments with many students per faculty member or with many students. Student characteristics accounted for about half of the departmental variation in time in each discipline. An appendix contains four tables describing departmental characteristics. (Contains 6 tables, 17 figures, and 40 references.) (Author/SLD)

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INSTITUTIONAL FACTORS IN TIME TO THE DOCTORATE

Lawrence J. Stricker

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Educational Testing Service
Princeton, New Jersey
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Institutional Factors in Time to the Doctorate

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Abstract

The aim of this study was to delineate departmental differences in the length of time that doctoral students take to receive their degrees and the institutional characteristics linked with it, being as comprehensive as possible in the institutional characteristics examined and disentangling the confounding effects of student characteristics. Variables describing graduate departments in three disciplines (Chemistry, English, and Psychology) and their parent universities were obtained from available records. In analyses of departments in each discipline, a relatively small set of institutional variables correlated with average time to the doctorate for the department, after controlling for characteristics of students in the department, and these relationships differed from discipline to discipline. The clearest and most extensive findings emerged for Psychology: the institutional variables identified primarily concerned faculty accessibility (student/faculty ratio and department size)--longer time for departments with many students per faculty member or many students. Student characteristics accounted for about half of the departmental variation in time in each discipline.

The time that doctoral students take to receive their degrees has long been a matter of concern (e.g., Berelson, 1960; Wilson, 1965). Undue time is not only a direct source of frustration and wasted time and money for the students and the institutions, but also an indirect source of frustration and waste because undue time contributes to attrition (e.g., Tucker, Gottlieb, & Pease, 1964). This concern has been heightened by steady increases in the time since the late 1960s (Coyle & Thurgood, 1989; Tuckman, Coyle, & Bae, 1990). The median years (time registered in graduate school) for all U.S. doctoral recipients increased from 5.4 in 1967 to 6.9 in 1987; the same trends were observed within disciplines (Coyle & Thurgood, 1989).

How much time is required to complete the doctorate may have many determinants (Hartnett & Willingham, 1980). It undoubtedly reflects characteristics of the students themselves to some extent. For instance, time (time from baccalaureate to graduation) is associated with GRE General Test and Subject Test scores, undergraduate grades, and recommendations (see the review by Willingham, 1974). Time (time registered in graduate school) is also related to ethnicity and citizenship (Coyle & Thurgood, 1989). Time (time registered in graduate school or time from first enrollment in graduate school until graduation) is associated with source of financial support (e.g., own earnings, assistantships) (Bowen & Rudenstine, 1992; Coyle & Thurgood, 1989). And time (time registered in graduate school, time from baccalaureate to graduation) is related to sex (Bowen & Rudenstine, 1992; Coyle & Thurgood, 1989).

Institutional factors--characteristics of the graduate departments and their parent universities--may also play an important role. The length of time varies <u>among</u> disciplines. In a study of graduate departments in 32 disciplines, the mean number of years to attain the doctorate (time from first enrollment in graduate school until graduation) for 1975-1979 graduates ranged

from 5.9 for Chemistry departments to 10.0 for Music departments (Jones, Lindzey, & Coggeshall, 1982). The median years (registered time to degree) for all U.S. doctoral recipients in 1987 ranged from 5.8 for those in Engineering fields to 8.4 for those in Humanities fields (Coyle & Thurgood, 1989). The median years (time from first enrollment in graduate school until graduation) ranged from (a) 5.9 for Mathematics to 8.3 for History for 1967-1971 baccalaureates receiving doctorates from all U.S. universities and (b) 5.1 for Mathematics to 7.2 for History for the 1967-1971 entering students receiving doctorates in eight universities (Bowen & Rudenstine, 1992). And the median years (time from fellowship award to graduation) for students awarded Danforth and Woodrow Wilson fellowships in 1962-1971 and receiving doctorates in all U.S. universities ranged from 5.3 for Mathematics to 7.1 for History (Bowen & Rudenstine, 1992).

Furthermore, the time to degree also varies <u>within</u> disciplines. In the study of graduate departments in 32 disciplines (Jones et al., 1982), the median years (time from first enrollment in graduate school until graduation) for 1975-1979 graduates were 5.4 for the slowest tenth of Cellular/Molecular Biology departments to 7.0 for the fastest tenth of these departments in the frequency distribution for this variable; the corresponding range was 7.3 to 12.8 for Music departments.

Apart from such descriptive statistics, hard data are sparse on the role of the graduate departments or their parent universities in time to the doctorate. And, of course, the between- and within-discipline data are confounded, to some unknown degree, by corresponding between- and within-discipline differences in student characteristics.

Between-discipline differences in student characteristics are well established. Two studies concern students. In a study of graduate

departments in Chemistry, History, and Psychology, reporting the mean of the department means, the percentage of men ranged from 65% for Psychology to 85% for Chemistry, the percentage under 30 years of age ranged from 56% for History to 84% for Chemistry, the percentage of Whites ranged from 79% for Chemistry to 90% for Psychology, the percentage of citizens ranged from 82% for Chemistry to 93% for Psychology, the percentage with an undergraduate GPA of 3.50 or above ranged from 31% for Chemistry to 47% for Psychology, the percentage of full-time students ranged from 69% for History to 92% for Chemistry, and the percentage planning on employment in an academic setting ranged from 28% to 37% for Chemistry to 86% to 90% for History (Clark, Hartnett, & Baird, 1976). In a survey of 1986 doctoral students in all U.S. universities, the percentage with financial aid ranged from 47% for Education fields to 93% for Engineering fields (Korb, Schantz, & Zimbler, 1989).

Two studies concern graduates. In the study of graduate departments in 32 disciplines, the mean percentage of 1975-1979 graduates with competitive fellowships ranged from 12% for Music departments to 59% for Cellular/ Molecular Biology departments (Jones et al., 1982). In a study of graduate departments in eight disciplines, the mean SAT Verbal scores for 1981 doctoral recipients ranged from 575 for graduates of Chemistry departments to 639 for graduates of Mathematics departments; the corresponding range for SAT Mathematical scores was 593 for graduates of English departments to 733 for graduates of Mathematics departments (Hartnett, 1987). For all U.S. doctoral recipients in 1987, the percentage of men ranged from 45% for Education fields to 93% for Engineering fields, the percentage of Whites ranged from 88% for Education fields to 93% for Physical Science fields, the percentage of citizens ranged from 42% for Engineering fields to 85% for Education fields, the percentage relying on support from own earnings ranged from 7% for

Physical Science fields to 51% for Education fields, and the percentage with employment commitments in academic settings ranged from 26% for Engineering fields to 85% for Humanities fields (Coyle & Thurgood, 1989).

Less is known about within-discipline differences in student characteristics. In the study of graduate departments in three disciplines (Clark et al., 1976), the reported means and standard deviations of the department means for students' undergraduate GPA suggest a range (three standard deviations) of department means of 2.85 to 3.75 for Chemistry, 2.79 to 3.81 for History, and 3.23 to 3.71 for Psychology. In the same study, the percentage of male students in the departments ranged from 0% to 57% for History and 45% to 84% for Psychology (Hartnett, 1981). In the study of graduate departments in 32 disciplines, the percentage of 1975-1979 graduates with competitive fellowships ranged from 0% for the lowest tenth of Music departments to 26% for the highest tenth of these departments in the frequency distribution for this variable; the corresponding range was 22% to 88% for Cellular/Molecular Biology departments (Jones et al., 1982).

Despite the confounding between departmental differences in student characteristics and in time to degree, the results of two studies are noteworthy. In the study of 32 disciplines (Jones et al., 1982), time was associated with several measures of departmental quality (Baird, 1990).[1] The median correlations for all disciplines with length of time to doctorate were -.28 for ratings of the departments' "effectiveness of program in educating research scholars/scientists" by a national sample of faculty members in the same discipline and -.27 with corresponding ratings of the departments' "scholarly quality of program faculty." And the median correlation for the 22 scientific disciplines with time was -.22 for proportion of faculty members with research grants from the Alcohol, Drug Abuse, and Mental Health

Administration; National Institutes of Health; or the National Science Foundation (NSF). However, time was unassociated with other quality measures. The median correlation was -.08, for all disciplines, for an index of library size, and the median correlation was -.08, for the 22 scientific disciplines, for total expenditures for research and development in the field. Time was unrelated to several size measures: the median correlations were -.03 with number of faculty members, .00 with number of full-time and part-time doctoral students, and -.10 with number of graduates.

In a study of seven universities (Bowen & Rudenstine, 1992), time to doctorate (time from first enrollment in graduate school until graduation) for students entering in 1967-1976 was related to department size. The median years was 7.5 in large (in terms of number of entering graduate students) English, History, and Political Science departments (combined) and 6.4 for small departments; the corresponding medians were 6.0 for large and 5.7 for small Economics departments. Similarly, the median years (time from award to graduation) for students receiving Woodrow Wilson Fellows in 1957 to 1976 in eight institutions were 7.4 for large and 6.0 for small Humanities departments, and 7.5 for large and 6.0 for small Social Science departments; the corresponding statistics for Danforth Fellows were 7.5 and 6.5 for Humanities, and 6.8 and 6.0 for Social Science.[2]

In the same study, time was associated, in all fields, with whether the institution was a research university and with the institution's quality rating. Overall, the median years (time from first enrollment to graduation) for 1967-1971 baccalaureates who were doctoral recipients in all U.S. universities was 6.5 for major research universities and 7.3 for other universities. The median years (time from award to graduation) for Woodrow Wilson Fellows receiving awards in 1957 to 1966 at eight institutions was .4

years less in universities with the highest ratings for quality than for the other universities.

Two studies of universities, rather than departments, are also relevant. In an early study of 1950 to 1962 recipients of the Ph.D. at 24 universities (Tucker et al., 1964), time (time from baccalaureate to graduation) was generally related to the institution's quality rating, except for Humanities graduates. Overall, the mean years were 8.5 for institutions with the highest ratings and 9.2 to 9.4 for other institutions; the corresponding means for Humanities were 11.8 vs. 11.3 to 13.4. However, time (time registered in graduate school) was generally unrelated to the quality rating, again with the exception of Humanities graduates. Overall, the mean years were 3.9 for institutions with the highest ratings and 3.8 to 4.1 for other institutions; the Humanities means were 4.3 vs. 3.8 to 4.1.

In the same study, time (time from baccalaureate to graduation) varied with both quality rating and public vs. private control. In general, time was shorter for private institutions, but there was an interaction between quality rating and public vs. private control. For institutions with the highest quality ratings, time was shorter, in all fields, for private universities: overall, the mean years were 8.2 for private and 10.7 for public institutions. For institutions with lower quality ratings, time was longer for private universities: overall, the mean years were 12.6 to 13.9 for private and 10.3 to 11.3 for public institutions.

In an investigation of 132 universities (Solmon, 1976), time (time from baccalaureate to graduation) of 1972 graduates in all fields was positively associated with the number of Ph.D. recipients in all fields from the institution and public control of the institution, and negatively associated

with the institution's quality rating and the number of Ph.D. recipients in natural sciences from the institution.

The purpose of the present study was to delineate departmental differences in length of time to the doctorate and the institutional characteristics linked with it. Unlike previous investigations, the aim was (a) to be as comprehensive as possible in the institutional characteristics examined and (b) to disentangle the confounding effects of student characteristics.

Method

Samples

All of the available Chemistry, English, and Psychology graduate departments in the study of graduate departments in 32 disciplines (Jones et al., 1982) that met the requirements of the present investigation were included: 86 in Chemistry, 57 in English, and 62 in Psychology. The departments are listed in Table 1.[3]

The original study comprised 145 departments in Chemistry, 106 in English, and 150 in Psychology. These departments, accounting for more than 90% of the doctorates awarded in the disciplines during 1976-1978, were chosen because (a) they had awarded at least a specified number of doctorates in 1976 to 1979 (13 in Chemistry, 13 in English, 22 in Psychology) or (b) they had awarded at least one-third of that number in 1979.

Departments were excluded from the present study for several reasons.[4] The chief reason was that two major sources of data were available only for disciplines in each institution, rather than for departments in the institution. The two sources were (a) student characteristics, including criterion data, in the National Research Council (NRC) Survey of Earned Doctorates and (b) institutional characteristics in the Graduate Record

Examinations Board and Council of Graduate Schools in the United States (GRE/CGS) Directory of Graduate Programs/Graduate Programs and Admissions Manual. In order to ensure that the discipline-level data from these sources were comparable to the department-level data from other sources, it was necessary to define the disciplines to exclude institutional and student data from other departments in the same universities that were not in the original study but overlapped with the disciplines. An unavoidable consequence was the need to drop departments from the original study because they had programs that fell outside of this definition of the discipline or they were in institutions with other departments that were not in the original study but had programs that fell within the definition of the discipline. The definitions were drawn to correspond to the generally accepted definitions of the discipline and minimize exclusions of departments from the original study, as far as possible. The definitions appear in Table 2.[5]

Other general reasons for excluding departments follow:

a. Two or more departments in the same discipline in the original study were from the same institution, and hence could not be distinguished with the discipline-level data from the Survey of Earned Doctorates and Directory of Graduate Programs/Graduate Programs and Admissions Manual.

b. The Survey of Earned Doctorates data are only for recipients of the Ph.D. and similar doctoral degrees; professional degrees, such as the Psy.D., sometimes awarded in Psychology, are excluded. Consequently, the criterion data are available only for a fraction of the graduates in departments offering Psy.D.s and Ph.D.s, and the data on institutional characteristics in the Directory of Graduate Programs/Graduate Programs and Admissions Manual and elsewhere are not comparable.

c. Too few doctorates were awarded to ensure stable criterion data.

Chemistry, English, and Psychology were selected because (a) these disciplines span the humanities, behavioral sciences, and physical sciences; (b) considerable data about the characteristics of the departments in these disciplines are available from existing sources (surveys of English and Psychology departments by the MLA and APA/Council of Graduate Departments of Psychology (COGDOP), respectively, and NSF institutional surveys of Chemistry and Psychology research funds); and (c) the disciplines attract a large number of students (the number of GRE General Test examinees in 1986-1987, including those planning on master's degrees, was 2,882 for Chemistry, 6,036 for English, and 15,197 for Psychology; Educational Testing Service, 1988).

Insert Tables 1 and 2 about here

Variables

All of the data for the departments were obtained from available archival records. The sources of data are reported in Table 3.

These considerations guided the selection and derivation of variables:

1. The number of variables was minimized:

   a. A single indicator was chosen for each construct; when several indicators existed, an indicator available for two or more disciplines was selected.

   b. Several indicators were combined into one index, whenever possible (e.g., faculty salary).

2. The quality of the variables was maximized:

   a. Variables with a substantial amount of missing data were excluded.

b. Variables based on statistics (means, medians, percentages, ratios) were excluded when the number of observations was fewer than 10.

3. The independence of the institutional and student characteristics was maximized:

a. No student data (other than the number enrolled) were used in the institutional variables.

b. The student characteristics were limited to those that preceded entry to the department or were otherwise uninfluenced by the department.

4. The effects of institutional size (number of students or faculty in the department or university) were minimized by expressing variables on a per capita basis, whenever possible (e.g., Ratio of Available Fellowships and Assistantships to Students, Ratio of Current Periodicals to Students).

Student characteristics. The student characteristics were based on data for 1984-1988 doctoral recipients in the three disciplines (as defined previously), aggregated over the five years to increase the number of observations. The characteristics, available for departments in all disciplines, can be categorized as demographic variables, undergraduate institution, and graduate career. These variables are listed in Table 4.[3]

Time to doctorate. Time to doctorate was based on data for the same cohort of 1984-1988 doctoral recipients from which the student characteristics were obtained, aggregated over the five-year period. This variable, available for departments in all disciplines, was defined as Median Years from First Enrollment in Graduate School to Graduation.

Note that this measure is based on first enrollment in any graduate school, not necessarily the same school and department that awarded the Ph.D. Data on first enrollment in the same school or the same department were unavailable. The present measure, also used in the 32-discipline study (Jones

et al., 1982) and the 10-university investigation (Bowen & Rudenstine 1992), was preferable for the purposes of the present research to other common alternatives: time from baccalaureate to graduation and time registered in graduate school (e.g., Coyle & Thurgood, 1989; Tuckman et al., 1990). Time from baccalaureate to graduation includes time spent prior to entering graduate school (e.g., working), not under the department's control; time registered in graduate school excludes time spent away from graduate school that may be under the department's control (e.g., temporary dropouts because of discouragement or financial difficulties).

Institutional characteristics. The institutional characteristics were obtained, whenever possible, for several points that span the graduate-school career of the cohorts being studied: 1972 and 1975 (English only), and 1978, 1981, 1984, and 1987 (all disciplines). This span was based on data for the frequency distribution of the departments' median years to attain the Ph.D. (time from first enrollment in graduate school until graduation) in the study of 32 disciplines (Jones et al., 1982): 8 years for Chemistry, 14 years for English, and 9 years for Psychology represent three standard deviations above the mean for the departments in these disciplines. Hence, students graduating in 1984 to 1988 would be expected to have entered no earlier than 1976 to 1980 for Chemistry, 1970 to 1974 for English, and 1975 to 1979 for Psychology.

The main set of institutional characteristics, available for departments in all disciplines, can be roughly categorized as (a) the departments' size, selectivity, requirements, availability of faculty, faculty quality, learning and research resources, and financial assistance; and (b) the parent universities' control, size, faculty quality, learning resources, and financial assistance. These variables appear in Table 5.[3] An additional set of institutional characteristics, covering many of these same categories, was

available for departments in one or two disciplines. These variables are shown in Table 6.[3]

Insert Tables 3 to 6 about here

Analysis

All of the analyses were done separately for the Chemistry, English, and Psychology departments. Product-moment correlations were computed between each institutional characteristic and the time-to-doctorate variable, using a pair-wise missing-data program. Semipartial (or "part") correlations between the institutional variables and the time variable were then computed, partialing a set of student characteristics out of the time variable only, to control for department differences in time-to-the-doctorate associated with corresponding student differences. (In order to reduce the number of covariates for the semipartial correlations, given the relatively small samples involved, but also keep these variables comparable for all disciplines, the set of covariates were limited to only those student characteristics that correlated with the time variable in every discipline.)

In assessing the significance of the semipartial correlations, the smallest N involved was used. Because of the relatively small samples, the .10 significance level (two-tailed) was employed in evaluating the zero-order and semipartial correlations. And because of the large number of institutional variables, the focus was on consistent patterns in their correlations within or between disciplines.

Results

Correlations Between Student Characteristics and Time to Doctorate

The zero-order correlations of the student characteristics with the time-to-doctorate variable for Chemistry, English, and Psychology are reported in Table 4.[6] Four variables correlated significantly with Median Years from First Enrollment in Graduate School to Graduation in all disciplines: Percentage of Women (r = .23 to .36), Percentage with College-Educated Fathers (r = -.29 to -.48), Percentage with Competitive Fellowships (r = -.24 to -.37), and Percentage Not Transferring from Another Graduate Program (r = -.49 to -.73). These variables' multiple correlations with time were .75 ($p < .01$) for Chemistry, .67 ($p < .01$) for English, and .68 ($p < .01$) for Psychology.[7]

Correlations Between Institutional Characteristics and Time to Doctorate

The semipartial correlations of the institutional characteristics with the time-to-doctorate variable for the three disciplines, partialing out of the latter the set of four student characteristics (Percentage of Women, Percentage of College-Educated Fathers, Percentage with Competitive Fellowships, and Percentage Not Transferring from Another Graduate Program) identified in the previous analysis, appear in Tables 5 and 6.[8] The corresponding zero-order correlations are also shown in these tables for reference purposes. Scatterplots for significant semipartial correlations are shown in Figures 1 to 16.[9]

For Chemistry departments, Median Years from First Enrollment in Graduate School to Graduation consistently correlated significantly with one multi-year variable: Department: Amount of Research and Development Expenditures for Discipline (r = .22 to .31). (This criterion also had scattered significant correlations with two other multi-year variables: Department: Ratio of Available Fellowships and Assistantships to Students,

and University: Average Faculty Compensation.) Time did not correlate significantly with other variables.

For English departments, Median Years from First Enrollment in Graduate School to Graduation consistently correlated significantly with one multi-year variable: University: Ratio of Current Periodicals to Students (r = .42 to .44). (This criterion also had scattered significant correlations with two other multi-year variables: University: Number of Graduate Students and University: Percentage of Graduate Students.) This criterion also correlated significantly with Department: Ratio of Undergraduate Majors Graduating to Faculty (r = -.35).

For Psychology departments, Median Years from First Enrollment in Graduate School to Graduation consistently correlated significantly with three multi-year variables: Department: Number of Students (r = .25 to .43), Department: Ratio of Students to Faculty (r = .51 to .53), and University: Ratio of Current Periodicals to Students (r = .42 to .43). (This criterion also had scattered significant correlations with one other multi-year variable: University: Ratio of Volumes to Students.) This criterion also correlated significantly with Department: Masters Students Admitted (r = .27), Department: Year Founded (r = .22), and Department: Admit Doctoral Students Without Support (r = .34).

More differences than similarities appeared in the patterns of correlations for the three disciplines. Only one similarity emerged: in both English and Psychology, time was greater for departments in universities with many periodicals per student. In contrast, there were several differences: in Chemistry alone, time was greater for departments with large expenditures for research and development in that discipline; in Psychology only, time was

greater for departments with many graduate students and many graduate students per faculty member.

Insert Figures 1 to 16 about here

Time to Doctorate for Individual Departments

The Median Years from First Enrollment in Graduate School to Graduation for each department in the three disciplines, controlling for the set of four student characteristics used in the preceding analysis (i.e., actual median - predicted median), ranged from a low of -1.1 to a high of 2.0 for Chemistry, from -3.3 to 4.7 for English, and -1.7 to 3.3 for Psychology.

Discussion

Student Characteristics

An unexpected but important finding in this study was the strong association between student characteristics and departmental differences in time to the doctorate. A small set of student characteristics, employed as control variables in the correlation analysis, accounted for about half of the departmental variation in time in each discipline. This outcome parallels results of studies at the undergraduate level which found that institutional variation in students' achievement and aspirations in college was largely predictable from the students' pre-existing characteristics, such as admissions test scores (e.g., Astin, 1968). The present findings may underestimate the relationship between student characteristics and time to the doctorate. Only a few variables were used, and measures of students' ability and motivation were not represented, except for whether the students had competitive fellowships. Other ability and motivation variables, including conventional measures, such as admissions test scores and undergraduate GPA,

were unavailable. And the relatively small samples of departments make it impractical to assess the overall association with time for the full set of student variables that are available (e.g., via multiple correlations).

It should be recognized that this strong showing for student characteristics, though important in its own right, does not imply that institutional characteristics are of little consequence. The relative contribution of these two sets of variables to departmental variation in time to the doctorate cannot be gauged directly from their correlations with this criterion, given the inevitable interdependence between the two.

Further work along these lines may benefit by using "multilevel analyses" that have been recently developed and applied to the study of school effectiveness (e.g., Bock, 1989). This analytical approach can assess within-department student effects and between-department institutional effects, apportioning the variance associated with each kind of effect, assessing interactions between students and departments, and identifying the variables related to the within- and between-department effects. Such an analysis was not feasible in the present study, for it requires data for individuals, but only aggregate data for the departments' graduates were available. The unavailability of data for individuals also ruled out a potentially more precise version of the present analysis that controls for student characteristics, using students instead of their departments as the unit of analysis in adjusting time and then aggregating these adjusted time measures for each department (Astin & Panos, 1969).

Institutional Characteristics

A major outcome is that only a limited set of institutional variables were associated with time to the doctorate, and these relationships differed from discipline to discipline. The clearest and most extensive findings

emerged for Psychology. The student/faculty ratio and department size variables associated with time--longer time for departments with many students per faculty member or many students--represent faculty accessibility. Two recent studies demonstrated that graduate students' contacts with faculty--being treated as a colleague (Berg & Ferber, 1983; Girves & Wemmers, 1988) and generally being involved in departmental activities (Girves & Wemmers, 1988)--were associated with success in obtaining the doctorate. The presence of relatively few students in a department facilitates, though it does not guarantee, such contacts. And student-faculty relationships may be less formal in smaller departments, thereby encouraging more contacts (see the review by Pascarella, 1980).

The reasons are uncertain for the counterintuitive positive associations between research and development expenditures and time to the doctorate, which appeared for Chemistry only: longer time for departments with greater funds. One speculation is that large-scale research activity in a department impedes producing doctoral students quickly: the research limits faculty accessibility, students are exploited as research assistants, etc. However, this explanation is inconsistent with findings from the three-discipline study (Clark et al., 1976). In Chemistry departments, the percentage of faculty with research grants and faculty perceptions of the program emphasis on research correlated minimally, at the department level, with student perceptions of the "environment for learning" (i.e., the extent to which the department provides a supportive environment or of "faculty concern for students" (i.e., the extent to which faculty members in the department are interested in the welfare and professional development of students). Another conjecture is that students take advantage of the available research resources to do more elaborate (and time-consuming) dissertations and to conduct other

research in order to foster their careers and improve their employment opportunities (W. Emmerich, personal communication, February 28, 1992). No evidence on this point is available.

The nature of the associations of the periodical measure with time to the doctorate, for both English and Psychology--longer time for institutions with more periodicals per student--may indirectly reflect an institutional orientation towards natural science, given its reliance on periodicals (Carrter, 1966), that disadvantages graduate education in English and Psychology (B. J. Huber, personal communication, March 31, 1992). Data on this speculation are lacking.

The wide variety of institutional characteristics that were completely unrelated to time to the doctorate in all of the disciplines is noteworthy. These comprised both departmental variables (selectivity, requirements, faculty quality, and learning resources) and university variables (control and financial assistance).

The widespread absence of significant relationships and the associated inconsistencies in these relationships from discipline to discipline were not due to lack of statistical power associated with the relatively small samples involved. The mean power to detect a semipartial correlation of .36 (considered to be a "medium" effect size in the population), using the .10 significance level--two-tailed, was .94 for Chemistry, .78 for English, and .78 for Psychology, all close to the recommended power standard of .80 (Cohen, 1988).

The diverse patterns of relationships among the institutional variables and time to the doctorate in Chemistry, English, and Psychology may reflect inherent differences in the nature of the disciplines. As an illustration, faculty and students are much more likely to work together on research

projects in Chemistry than in the other fields (e.g., Bowen & Rudenstine, 1992). Hence, greater contact between faculty and students is insured in this discipline. Other differences may also be relevant. For instance, research in Chemistry is closely tied to course work (Wilson, 1965); research in English is largely unrelated to course work. In contrast to research in the other disciplines, work in Chemistry is heavily dependent on elaborate laboratory equipment, making it difficult for a student to continue dissertation research if he or she does not remain in residence at the university (e.g., Mooney, 1968). Considerably more funds are available for research in Chemistry than in Psychology, and English probably has little support (e.g., Jones et al., 1982). Faculty in English are more interested in teaching and do less research than Chemistry and Psychology faculty (Feldman, 1974). More financial aid is provided in Chemistry than in other fields, and research assistantships predominate in Chemistry whereas teaching assistantships are very common in English (e.g., Korb et al., 1989), affecting the nature and extent of the contact with the faculty (e.g., Wilson, 1965). Dissertations are shorter and easier to write in Chemistry than in the other disciplines (Berelson, 1960). Compared to the other fields, graduate education in Chemistry is more structured and the requirements are more explicit (e.g., Wilson, 1965). Students in English prepare for academic positions whereas many Chemistry students plan for jobs in government and industry, with Chemistry being more responsive to labor market considerations (e.g., Breneman, 1975; Clark et al., 1976; Tuckman et al., 1990).

The present results generally diverge from those reported in previous studies. These investigations found that time was positively associated with (a) the quality rating of the department or its parent university (Bowen & Rudenstine, 1992; Jones et al., 1982; Solmon, 1976; Tucker et al., 1964), (b)

the size of the department or its university (Bowen & Rudenstine, 1992; Solmon, 1976), and (c) public control of the university (Solmon, 1976; Tucker et al., 1964). These studies also found that time was negatively associated with (a) the proportion of the faculty with federal research grants (Jones et al., 1982) and (b) whether the institution was a research university (Bowen & Rudenstine, 1992).

In addition, one investigation (Jones et al., 1982) found no overall association between time and size, but observed a positive association between time and size for Psychology and a negative association between time and size for Chemistry. This same study also found no overall association between research and development expenditures and time but observed a negative association for Chemistry. The same study also found no overall association between time and library size but observed a negative association for Chemistry and English.

Unlike these often substantial relationships, the associations in the present investigation were generally minimal, with few exceptions. One exception concerns the positive association between time and size for Psychology, consistent with two of the previous studies (Bowen & Rudenstine, 1992; Jones et al., 1982). A second exception involves the positive associations between time and the periodicals measure for English and Psychology, somewhat inconsistent with previous results--a negative association for a global measure of library size for English, and a minimal association for this measure for Psychology (Jones et al., 1982).

In sharp contrast, the relationships reflected in the zero-order correlations between the institutional variables and time in this investigation, which do not control for student characteristics, are generally substantial and consistent with the previous results. One clear exception is

the minimal associations with size for English, inconsistent with the negative associations in one study (Bowen & Rudenstine, 1992), but consistent with the associations in another investigation (Jones et al., 1982). A second exception is the minimal association with public control of the institution, inconsistent with the positive associations in two earlier studies (Solmon, 1976; Tucker et al., 1964).

Controlling for student characteristics in the present study appears to be the general explanation for the divergences in its results from those reported previously. However, this explanation cannot account for the findings about size and quality rating based on data for holders of Danforth and Woodrow Wilson fellowships (Bowen & Rudenstine, 1992). Because these fellowships are awarded on the basis of merit and ensure adequate financial aid, these results effectively controlled for important student characteristics. These findings were based on a small group of elite universities, though, and may not be generalizable to the broader sample of institutions in the present investigation.

Research Implications

The variables used in this study consisted of "external" indicators of the institutional environment, public in nature (Clark et al., 1976). "Internal" indicators, of a more private character, such as student or faculty perceptions of the environment, were not included. The two kinds of indicators overlap but may not be interchangeable. In the study of departments in three disciplines (Clark et al., 1976), several of the same variables used in the present investigation (Number of Students, Ratio of Students to Faculty, Rating of Quality of Faculty) correlated moderately, at the department level, with student perceptions of the environment for learning, and one of these variables (Rating of Quality of Faculty) also

correlated with student perceptions of faculty concern for students. These relationships were limited to History; all of the correlations were minimal for Chemistry and Psychology.

Student and faculty perceptions of the department environment would be a useful, though difficult to obtain, source of data in studying departmental variations in time to doctorate. Surveys in the 1950s of recent recipients of the Ph.D., graduate faculty, and graduate deans found that all of these groups considered dissertation supervision an important factor in time to the doctorate (Berelson, 1960; Wilson, 1965). One of these surveys also found that the three groups considered exploitation as research assistants, with the major professors retaining graduate students to pursue the professors' interests, to be another important factor (Berelson, 1960). The previously discussed findings on the relationships between contacts with faculty and attainment of the Ph.D. (Berg & Ferber, 1983; Girves & Wemmers, 1988) also suggest that data based on direct observations of the department environment are pertinent. Nonetheless, in the three-discipline study, students' perceptions of the environment for learning and of faculty concern for students in the department did not correlate, at the department level, with estimates of attrition, apart from an inexplicable negative correlation, for Chemistry only, for the environment for learning: poorer environments had less attrition (Clark et al., 1976).

Standardized questionnaires already exist for assessing student and faculty perceptions of the department environment (e.g., see the review by Baird, 1974) and could be used to survey large samples of departments. An alternative would be small-scale qualitative studies of a few departments, perhaps chosen because they define the ends of the time-to-doctorate continuum, with campus visits, interviews with deans, department chairs,

faculty, and students, and so on (e.g., Dressel, Johnson, & Marcus, 1970). This approach would be very labor intensive but also potentially very rich in the insights it provides about the institutional environment.

In view of the important role that student characteristics appear to play in time to the doctorate, it would be valuable to redouble efforts to identify individual-difference variables that may be implicated. The pertinent cognitive variables are probably already captured by the GRE General Test and Subject Tests, and undergraduate GPA (see the review by Willingham, 1974). And a great deal is known about the relevant demographic, financial, and academic career variables (e.g., Coyle & Thurgood, 1989). But temperament and motivation variables have largely been neglected thus far. Their potential relevance is illustrated by two recent studies which found that measures of conscientiousness were related to time to the doctorate (Gough, 1983) and attainment of the doctorate (Hirschberg & Itkin, 1978). These results are congruent with findings about the importance of "follow-through" in college success (Willingham, 1985; Willingham & Breland, 1982).

Policy Implications

Given the inherent limitations of correlational studies and the difficulties involved in controlling for irrelevant variance, caution is needed in translating the results of this investigation into policy recommendations (A. Fechter, personal communication, May 27, 1992; R. T. Hartnett, personal communication, March 16, 1992; J. B. LaPidus, personal communication, March 18, 1992). It would obviously be foolhardy, for instance, to conclude that financial aid to graduate students can be eliminated on the basis of the observed lack of association between time to the doctorate and the availability of fellowships and assistantships

(R. T. Hartnett, personal communication, March 16, 1992). Nonetheless, some policy implications are clear.

The sparse and relatively modest correlations of institutional variables with time to the doctorate underscore the recent observation that there are limits to what institutions can do to reduce the time, for not all of the causes are under the control of universities (Association of American Universities, 1990).

A related implication is that increased efforts to reduce time by improved screening of students may be fruitful, as already mentioned, and as recommended before (Tucker et al., 1964; Zwick & Braun, 1988).

The diverse pattern of results for the three disciplines, also observed in other studies in this area (Baird, 1990; Tuckman et al., 1990; Wilson, 1965), suggests that solutions to the time problem will vary from field to field, as pointed out previously (Bowen & Rudenstine, 1992; Wilson, 1965).

The wide variation in time to doctorate among departments in the same discipline, even after controlling for student characteristics, argues for routinely providing information on this matter to prospective students to use in their decision making, as others have proposed (Association of American Universities, 1990; Bowen & Rudenstine, 1992). These data would also be useful to departments in developing realistic expectations about what should be required of students, as advocated by other observers (Bowen & Rudenstine, 1992; Wilson, 1965).

The direct relation between department size and time, in Psychology, might be construed as an argument in favor of reducing the size of departments, at least in Psychology and similar disciplines. But such a solution might not only be unfeasible but also counterproductive (Decker, 1973; Heiss, 1979). However, a variety of other measures are possible that

might ameliorate the limited interaction among students and between students and faculty that is a major, but not sole, concomitant of size (Bowen & Rudenstine, 1992). These range from improving faculty advising, providing better opportunities for interactions between students and faculty, and furnishing more office space for students (Bowen & Rudenstine, 1992; Heiss, 1970; Tucker et al., 1964; Wilson, 1965).

A final point is the need to distinguish between relevant and irrelevant time. The actual time involved in doctoral work may be irreducible, but the irrelevant time produced by part-time or discontinuous attendance is potentially alterable (Berelson, 1960; Grigg, 1965; Wilson, 1965). Hence, efforts at reducing time need to focus on the latter, not the former.

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Footnotes

[1]The signs of all these correlations have been changed because the original scoring of length of time has been reversed--a longer time is now assigned a higher score.

[2]In the analyses of all students and of Fellows, median times are also reported for Mathematics and Physics, but these results are not readily interpreted because the size categorizations of the departments in these two disciplines are problematic.

[3]Data from subsequent analyses are also reported in this table.

[4]Specific bases for excluding departments follow:

1. Data were unavailable on time to the doctorate:

a. The data included doctorates awarded by more than one department in the university. Departments, other than Psychology departments, were identified as offering degrees in Clinical, Developmental, Experimental, and Industrial/Organizational Psychology by screening 1978, 1982, and 1986 editions of the American Psychological Association (APA) Graduate Study in Psychology and Associated Fields. In addition, two Chemistry departments and two Psychology departments in the same universities were in the original study.

b. The department awarded doctorates in fields outside of the discipline, as defined in the study. English departments offering Ph.D.s in Comparative Literature or Linguistics were identified from the raw data in 1983 and 1986 Modern Language Association (MLA) surveys of departments, respectively. Psychology departments offering Ph.D.s in Counseling, Educational, or School were identified by screening 1978, 1982, and 1986 editions of the APA Graduate Study in Psychology and Associated Fields.

c. The department awarded too few doctorates (less than 10).

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2. Data were unavailable for institutional characteristics in the GRE/CGS Directory of Graduate Programs/Graduate Programs and Admissions Manual.

a. The institutional listing for the discipline in the directory ("Chemistry," "English Language and Literature/English," "Psychology") included fields outside of the discipline, as defined in this study: Pharmaceutical/Medicinal for Chemistry, Teaching English as a Foreign Language for English, and Counseling for Psychology departments. These departments were identified by screening 1973-1974, 1975-1976, 1977-1979, 1979-1981, 1981-1983, 1984-1985, 1986-1987, and 1988-1989 editions of the directory.

b. The data for Psychology included Psy.D. students and graduates. Departments offering Psy.D.s were identified by screening the 1978, 1982, and 1986 editions of the APA Graduate Study in Psychology and Associated Fields.

[5]The number of graduates in this study in the Survey of Earned Doctorates subfields used to define the disciplines are reported in Table A-1 in the Appendix.

[6]The corresponding means and standard deviation for the student characteristics are reported in Table A-2 in the Appendix. The means and standard deviations for the time-to-doctorate variable also appear in this table.

[7]The standardized regression coefficients for Percentage of Women, Percentage of College-Educated Fathers, Percentage with Competitive Fellowships, and Percentage Not Transferring from Another Graduate Program are .15, .00, .05, and -.73 for Chemistry; .33, -.22, -.09, and -.35 for English; and .29, -.20, -.33, and -.39 for Psychology, respectively.

[8]The corresponding means and standard deviations for the institutional characteristics are reported in Tables A-3 and A-4 in the Appendix.

[9]The associations portrayed by the scatterplots may diverge from those represented by the corresponding semipartial correlations because of missing data.

Table 1

Chemistry, English, and Psychology Departments in Study

Department
Chemistry
University of Louisville
State University of New York at Binghamton
State University of New York at Buffalo
University of Oregon
University of Vermont
American University
University of California--Santa Cruz
University of Nebraska--Lincoln
Cornell University
Howard University
Tulane University
University of Colorado at Boulder
University of Pennsylvania
Colorado State University
Harvard University
New York University
Northern Illinois University
University of Southern Mississippi
University of Tennessee--Knoxville
California Institute of Technology
Montana State University

Table 1 (continued)

Department
University of Idaho
University of Illinois at Urbana-Champaign
Polytechnic University
University of Chicago
University of Hawaii at Manao
University of Rochester
Brigham Young University
Drexel University
Florida State University
Georgetown University
Pennsylvania State University (University Park)
University of New Hampshire (Durham)
Stanford University
University of Kentucky
Yale University
Iowa State University
Texas A & M University (College Station)
Michigan State University
North Carolina State University at Raleigh
Syracuse University
Ohio University (Athens)
University of Connecticut
University of New Mexico (Albuquerque)

Table 1 (continued)

Department
University of Southern Illinois--Carbondale
Johns Hopkins University
Kent State University (Kent)
State University of New York at Stony Brook
University of California--Berkeley
University of California--Davis
University of Cincinnati (Cincinnati)
University of Massachusetts at Amherst
Duke University
University of California--Riverside
University of Miami
Arizona State University
Clarkson University
Kansas State University
Northwestern University
Oklahoma State University (Stillwater)
University of California--Los Angeles
University of Georgia
University of South Florida
Columbia University
Massachusetts Institute of Technology
Rice University
University of California--Irvine

Table 1 (continued)

Department
University of New Orleans
University of North Dakota (Grand Forks)
Case Western Reserve University
University of Maryland (College Park)
Louisiana State University
University of Delaware
University of South Carolina--Columbia
Rensselaer Polytechnic Institute
University of Wyoming
University of Houston--University Park
University of Iowa
Clemson University
University of North Texas
Washington University
Georgia Institute of Technology
University of Arkansas--Fayetteville
University of Missouri--Columbia
Vanderbilt University
Baylor University
English
University of Chicago
Washington State University

Table 1 (continued)

Department
Saint Louis University
Catholic University of America
New York University
Syracuse University
Tufts University
University of Denver
Georgia State University
Rutgers University--New Brunswick
Duke University
Wayne State University
City University of New York Graduate School and University Center
Florida State University
University of California--Davis
University of South Carolina--Columbia
Boston University
Fordham University
Lehigh University
Boston College
Washington University
Ball State University
University of California--San Diego
Indiana University--Bloomington

Table 1 (continued)

Department
Northern Illinois University
University of Massachusetts at Amherst
University of California--Riverside
University of Connecticut
University of Iowa
University of California--Santa Barbara
University of California--Berkeley
Harvard University
University of Mississippi
Johns Hopkins University
University of North Dakota (Grand Forks)
Bowling Green State University (Bowling Green)
Vanderbilt University
University of Nebraska--Lincoln
University of Tulsa
University of Utah
University of North Carolina at Chapel Hill
Cornell University
Emory University
State University of New York at Stony Brook
Yale University
Brandeis University
University of Tennessee--Knoxville

Table 1 (continued)

Department
University of Delaware
State University of New York at Buffalo
University of Rochester
Brown University
Pennsylvania State University (University Park)
Tulane University
University of Notre Dame
Rice University
State University of New York at Binghamton
Bryn Mawr College
Psychology
New School for Social Research
University of Chicago
University of Louisville
Northeastern University
Yale University
City University of New York Graduate School and University Center
University of North Carolina at Greensboro
Temple University
Duke University
George Washington University

Table 1 (continued)

Department
Emory University
Stanford University
University of Connecticut
University of Utah
Brandeis University
University of Toledo
Rutgers University--Newark
Long Island University--Brooklyn Center
University of California--Berkeley
De Paul University
Miami University at Oxford
University of Wyoming
University of Arizona
University of Kentucky
Harvard University
Claremont Graduate School
University of California--Riverside
University of Arkansas--Fayetteville
University of California--San Diego
University of Delaware
University of South Florida
California School of Professional Psychology--San Diego

Table 1 (continued)

Department
Kansas State University
Columbia University
Rice University
State University of New York at Binghamton
Bryn Mawr College
Indiana University--Bloomington
Kent State University (Kent)
University of Alabama--Tuscaloosa
University of Colorado at Boulder
University of North Carolina at Chapel Hill
Brown University
California School of Professional Psychology--Berkeley
Clark University
University of Vermont
Wayne State University
Fuller Theological Seminary (Pasadena)
University of California--Santa Barbara
University of Iowa
University of Mississippi
University of South Dakota
Case Western Reserve University
Texas Christian University

Table 1 (continued)

Department
Bowling Green State University (Bowling Green)
University of Miami
Washington University
University of Pennsylvania
University of Illinois at Chicago
Virginia Polytechnic Institute and State University
Princeton University
Johns Hopkins University

Table 2

Discipline Definitions for Survey of Earned Doctorates and Directory of Graduate Programs/Graduate Programs and Admissions Manual

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Survey of Earned Doctorates

Chemistry

Analytical, General, Inorganic, Nuclear, Organic, Physical, Polymer, Theoretical, and Other Chemistry.[a]

English

American Literature, English Literature, English Language, General Letters, and Other Letters.[b]

Psychology

Clinical, Cognitive, Comparative, Developmental, Experimental, General, Industrial and Organizational, Personality, Physiological, Psychometrics, Quantitative, Social, and Other Psychology.[c]

Directory of Graduate Programs/
Graduate Programs and Admissions Manual

Chemistry

Agricultural, Analytical, Chemical Physics, Crystallography, Environmental, General, Inorganic, Nuclear, Organic, Physical, Polymer, and Theoretical.[d]

English

English Language and Literature, and Creative Writing.[e]

Psychology

Clinical, Developmental, Environmental, Experimental, General, Industrial, Organizational, Physiological/Psychobiology, Psychometrics, Social, and Statistics in Psychology.[f]

---

[a]Pharmaceutical is excluded.

[b]Speech and Debate is excluded.

[c]Counseling, Educational, and School are excluded.

[d]Pharmaceutical/Medicinal is excluded.

[e]Teaching English as a Foreign Language is excluded.

[f]Counseling is excluded.

Table 3

Sources of Data

All Disciplines
NRC Survey of Doctorates
GRE/CGS Directory of Graduate Programs/Graduate Programs and Admissions Manual
Center for Statistics (CS)/National Center for Education Statistics (NCES) Integrated Postsecondary Education Data System (IPEDS)/Higher Education General Information Survey (HEGIS)
American Association of University Professors (AAUP) Academe/AAUP Bulletin (surveys of faculty salaries)
Association of Research Libraries (ARL) ARL Statistics
Jones et al. (1982) An Assessment of Research-Doctorate Programs in the United States
Carnegie Foundation for the Advancement of Teaching/Carnegie Commission on Higher Education/Carnegie Council on Policy Studies in Higher Education A Classification of Institutions of Higher Education
Astin and Henson (1977) "New Measures of College Selectivity"
Fuller (1986) "Ph.D. Recipients--Where Do They go to College?" (Ph.D. productivity ratios)
Chemistry and Psychology
NSF Academic Science/Engineering R & D Funds
English and Psychology
MLA surveys of English departments
APA/COGDOP surveys of Psychology departments[a]
Psychology
APA Graduate Study in Psychology and Associated Fields

[a]Data were available only for the departments that permitted use of the information in this study.

Table 4

Student Characteristics: Correlations with Time to Doctorate for Chemistry, English, and Psychology Departments

Variable	Chemistry N	Chemistry Zero-order	English N	English Zero-order	Psychology N	Psychology Zero-order
Demographic						
Percentage of Women[a]	86	.23**	57	.36***	62	.25**
Percentage of Whites[a]	85	-.39***	56	-.10	62	.27**
Percentage of Citizens[a]	86	-.48***	57	.26**	62	.16
Percentage with College-Educated Fathers[a]	85	-.29***	56	-.48***	62	-.33***
Undergraduate Institution						
Average College Selectivity: 1973-1974[a,b]	78	-.01	55	-.31**	62	-.02
Percentage with High Ph.D. Productivity Ratio: All Fields: 1974-1976[a,c]	86	-.19*	57	-.23*	62	-.15
Percentage with Research Doctorate Universities: 1976[a,d]	79	.02	54	-.16	62	-.10
Percentage with Publicly Controlled Universities: 1976-1987[a,e]	79	-.02	55	.01	62	-.08
Graduate Career						
Percentage with Competitive Fellowships[a,f]	86	-.24**	57	-.34***	62	-.37***
Percentage Entering Graduate School Immediately After College[a]	86	-.30***	57	-.11	62	-.40***
Percentage Not Transferring from Another Graduate Program[a,g]	86	-.73***	57	-.49***	62	-.50***

Table 4 (Continued)

Variable	Chemistry N	Chemistry Zero-order	English N	English Zero-order	Psychology N	Psychology Zero-order
Percentage with Undergraduate Degree in Same Field[a,b]	86	-.14	57	-.16	62	-.60***
Percentage in Common Graduate Field[i]	86	-.25**	57	-.08	62	.07

[a]NRC Survey of Earned Doctorates, 1984-1988.

[a]Astin and Henson (1977) "New Measures of College Selectivity." This is the estimated total mean SAT score for 1973 entering freshmen.

[c]Fuller (1986) "Ph.D. Recipients--Where Do They Go to College? This is the proportion of 1946-1976 baccalaureates receiving Ph.D.s in 1951-1980 in all fields.

[d]Carnegie Council on Policy Studies in Higher Education A Classification of Institutions of Higher Education, 1976.

[e]NCES HEGIS XI: Fall Enrollment and Compliance Report of Institutions of Higher Education, 1976.

[f]ADAMHA, AEC/ERDA, NDEA, NIH, NSF, USDA, Ford Foundation, Rockefeller Foundation, Woodrow Wilson Foundation, and Other Non-Federal Nationally Competitive fellowships.

[g]Master's degree from same graduate program or no Master's degree.

[b]The set of Survey of Earned Doctorates subfields used in this study to define the disciplines.

[i]The common field is Organic for Chemistry, English Literature for English, and Clinical for Psychology.

Table 5

Institutional Characteristics Available for All Disciplines: Correlations with Time to Doctorate for Chemistry, English, and Psychology Departments

Variable	Chemistry N	Chemistry Zero-order	Chemistry Semi-partial	English N	English Zero-order	English Semi-partial	Psychology N	Psychology Zero-order	Psychology Semi-partial
			Department: Size						
Number of Faculty (FTE): 1971-1972[a,y]				36	-.20	-.11			
Number of Faculty (FTE): 1974-1975[b]	57	-.27**	-.13	43	-.19	-.13	42	.15	.14
Number of Faculty (FTE): 1978-1979[c]	68	-.19	-.08	44	-.20	-.19	54	.13	.10
Number of Faculty (FTE): 1982-1983[d]	70	-.18	-.10	46	-.06	-.04	50	-.20	-.11
Number of Faculty (FTE): 1986-1987[e]	69	-.21*	-.08	48	-.20	-.15	40	-.09	.16
Number of Students (FTE): 1971-1972[a,y]				47	.00	.06			
Number of Students (FTE): 1974-1975[b]	69	-.22*	.03	50	-.15	-.07	48	.41***	.43***
Number of Students (FTE): 1978-1979[c]	75	-.22**	.02	49	-.22	-.03	54	.34***	.31**
Number of Students (FTE): 1982-1983[d]	75	-.25**	.03	52	-.17	-.04	53	.30**	.25*
Number of Students (FTE): 1986-1987[e]	69	-.20*	.08	50	-.14	-.04	39	.38**	.36**
Number of Programs: 1971-1972[a,y]				37	-.13	.01			
Number of Programs: 1974-1975[b]	71	.00	.11	42	.11	.18	45	.00	-.09
Number of Programs: 1978-1979[c]	77	.14	.14				55	-.05	-.13
Number of Programs: 1982-1983[d]	79	-.09	-.05				55	-.01	-.01
Number of Programs: 1986-1987[e]	76	-.10	-.06				46	.15	.19

Table 5 (Continued)

Variable	Chemistry N	Chemistry Zero-order	Chemistry Semi-partial	English N	English Zero-order	English Semi-partial	Psychology N	Psychology Zero-order	Psychology Semi-partial
Department: Selectivity									
Number of Admission Requirements: 1982-1983[d]	35	-.09	-.08	28	-.08	.07	24	.01	-.19
Number of Admission Requirements: 1987-1987[e]	40	-.05	.06	29	-.26	-.05	21	.21	-.16
Department: Requirements									
Foreign Language Required: 1982-1983[d]	73	.05	-.10	52	-.03	.01	48	.19	.08
Foreign Language Required: 1986-1987[e]	70	.15	.04	51	-.07	.02	42	.29*	.18
Part-Time Entering Students Allowed: 1971-1972[a,y]				40	.09	.10			
Part-Time Entering Students Allowed: 1974-1975[b]	65	.16	-.04	45	.10	.02	41	.35**	.23
Part-Time Entering Students Allowed: 1978-1979[c]	70	.26**	.05	44	-.04	-.24	47	.25*	.21
Part-Time Entering Students Allowed: 1982-1983[d]	71	.19*	-.03	47	.35**	.12	46	.14	.08
Part-Time Entering Students Allowed: 1986-1987[e]	63	.13	.07	46	.30**	.13	34	.26	.08
Department: Faculty Availability									
Ratio of Students to Faculty (FTE): 1971-1972[a,y]				34	.20	.13			

Table 5 (Continued)

Variable	Chemistry N	Chemistry Zero-order	Chemistry Semi-partial	English N	English Zero-order	English Semi-partial	Psychology N	Psychology Zero-order	Psychology Semi-partial
Ratio of Students to Faculty (FTE): 1974-1975[b]	53	.05	.17	42	.20	.20	41	.51***	.53***
Ratio of Students to Faculty (FTE): 1978-1979[c]	66	-.11	.15	43	-.06	.17	52	.13	.06
Ratio of Students to Faculty (FTE): 1982-1983[d]	67	-.20	.07	44	-.20	-.01	49	.25*	.20
Ratio of Students to Faculty (FTE): 1986-1987[e]	63	.21*	.06	46	-.02	.10	34	.48***	.51***
Percentage of Full-Time Faculty: 1971-1972[a,y]				35	.06	-.19			
Percentage of Full-Time Faculty: 1974-1975[b]	57	-.06	.11	43	-.28*	-.22	41	-.15	.06
Percentage of Full-Time Faculty: 1978-1979[c]	68	-.12	.00	44	-.06	-.18	53	-.10	.08
Percentage of Full-Time Faculty: 1982-1983[d]	70	-.09	-.04	46	-.04	.07	49	-.21	-.06
Percentage of Full-Time Faculty: 1986-1987[e]	67	-.13	.05	48	-.07	.13	39	-.13	.13
Department: Faculty Quality									
Rating of Quality to Faculty: 1981[f]	86	-.34***	.01	57	-.49***	-.15	62	-.20	.09

Table 5 (Continued)

Variable	Chemistry N	Chemistry Zero-order	Chemistry Semi-partial	English N	English Zero-order	English Semi-partial	Psychology N	Psychology Zero-order	Psychology Semi-partial
Department: Learning Resources									
Rating of Program Effectiveness:1981[f]	86	-.33***	-.01	57	-.50***	-.18	60	-.20	.06
Ratio of Available Teaching Assistantships to Faculty (FTE): 1971-1972[a,y]				34	-.21	.04			
Ratio of Available Teaching Assistantships to Faculty (FTE): 1974-1975[b]	52	-.04	.07	39	.11	.09	37	-.08	-.02
Ratio of Available Teaching Assistantships to Faculty (FTE): 1978-1979[c]	68	-.02	.05	41	.02	.07	48	-.14	-.06
Ratio of Available Teaching Assistantships to Faculty (FTE): 1982-1983[d]	68	-.14	.07	46	-.16	-.12	48	-.04	-.13
Ratio of Available Teaching Assistantships to Faculty (FTE): 1986-1987[e]	64	-.04	.11	47	-.12	.12	36	.16	.18
Department: Research Resources									
Ratio of Available Research Assistantships to Faculty (FT): 1971-1972[a,y]				24	.03	-.15			
Ratio of Available Research Assistantships to Faculty (FT): 1974-1975[b]	72	-.25**	.02	35	-.09	-.11	43	.09	.15
Ratio of Available Research Assistantships to Faculty (FT): 1978-1979[c]	78	-.21*	.14	47	-.04	-.08	49	.02	.01
Ratio of Available Research Assistantships to Faculty (FT): 1982-1983[d]	78	-.29***	.01	50	.09	.07	49	.12	.13
Ratio of Available Research Assistantships to Faculty (FT): 1986-1987[e]	71	-.13	.15	48	.00	-.10	36	-.03	-.05

Table 5 (Continued)

Variable	Chemistry N	Chemistry Zero-order	Chemistry Semi-partial	English N	English Zero-order	English Semi-partial	Psychology N	Psychology Zero-order	Psychology Semi-partial
Department: Financial Assistance									
Ratio of Available Fellowships and Assistantships to Students: 1971-1972[a]				24	-.22	-.15			
Ratio of Available Fellowships and Assistantships to Students: 1974-1975[b]	64	-.23*	.09	34	-.25	-.13	43	-.41***	-.19
Ratio of Available Fellowships and Assistantships to Students: 1978-1979[c]	74	-.41***	-.22*	48	-.47***	-.24	52	-.22	-.07
Ratio of Available Fellowships and Assistantships to Students: 1982-1983[d]	73	-.39***	-.14	48	-.21	-.03	51	-.25*	-.04
Ratio of Available Fellowships and Assistantships to Students: 1986-1987[e]	65	-.27**	-.07	47	-.41***	-.10	37	-.47***	-.26
University: Control									
University Control Public: 1970-1971[a,y]				56	.02	-.10			
University Control Public: 1974-1975[h]	85	.05	.00	56	.02	-.10	59	.01	-.08
University Control Public: 1978-1979[i]	86	.04	.00	57	.02	-.11	61	.04	-.04
University Control Public: 1982-1983[j]	85	.04	.01	56	-.01	-.12	60	.02	-.05
University Control Public: 1986-1987[k]	84	.05	.01	56	.04	-.09	60	.04	-.01

Table 5 (Continued)

Variable	Chemistry N	Chemistry Zero-order	Chemistry Semi-partial	English N	English Zero-order	English Semi-partial	Psychology N	Psychology Zero-order	Psychology Semi-partial
University: Size									
Number of Faculty (FT): 1970-1971[l,y]				51	-.09	.01			
Number of Faculty (FT): 1973-1974[m]				51	-.16	-.08			
Number of Faculty (FT): 1976-1977[n]	76	-.01	.07	48	.00	.09	50	-.08	.07
Number of Faculty (FT): 1979-1980[o]	79	-.02	.02	54	-.05	.05	56	-.15	-.04
Number of Faculty (FT): 1982-1983[p]	85	-.09	-.02	56	-.09	.03	59	-.15	.00
Number of Faculty (FT): 1985-1986[q]	85	-.11	-.02	56	-.11	.03	56	-.10	.03
Number of Students (FTE): 1974-1975[h]	85	-.07	-.04	56	-.02	.03	59	-.18	-.08
Number of Students (FTE): 1978-1979[i]	84	-.07	-.02	56	.00	.01	60	-.16	-.03
Number of Students (FTE): 1982-1983[j]	83	-.10	-.05	55	-.04	-.02	59	-.16	-.03
Number of Students (FTE): 1986-1987[k]	85	-.10	-.03	57	-.09	.01	62	-.17	-.02
Number of Graduate Students (FTE): 1974-1975[h]	85	-.11	.04	56	.03	.20	59	-.07	.06
Number of Graduate Students (FTE): 1978-1979[i]	84	-.16	.02	56	.07	.23*	59	-.06	.09
Number of Graduate Students (FTE): 1982-1983[j]	83	-.22**	-.04	55	-.02	.17	58	-.02	.11
Number of Graduate Students (FTE): 1986-1987[k]	85	-.23**	-.03	57	-.10	.17	61	-.09	.07
Research Doctorate University: 1973[r]	-			57	-.14	.06			
Research Doctorate University: 1976[s]	85	-.18*	.03	57	-.06	.17	59	-.16	-.04

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Table 5 (Continued)

Variable	Chemistry N	Chemistry Zero-order	Chemistry Semi-partial	English N	English Zero-order	English Semi-partial	Psychology N	Psychology Zero-order	Psychology Semi-partial
Research Doctorate University: 1987[t]	86	-.25**	-.09	57	-.36***	-.08	59	-.29**	-.12
University: Faculty Quality									
Average Faculty Compensation (FT): 1969-1970[l,y,z]				51	-.29**	-.11			
Average Faculty Compensation (FT): 1973-1974[m,y,z]				51	-.24*	-.05			
Average Faculty Compensation (FT): 1976-1977[n,z]	76	.03	.24**	49	-.39***	-.09	50	.17	.16
Average Faculty Compensation (FT): 1979-1980[o,z]	79	-.13	.08	54	-.46***	-.16	56	.08	.18
Average Faculty Compensation (FT): 1982-1983[p,z]	85	-.17	.01	56	-.46***	-.17	57	.04	.21
Average Faculty Compensation (FT): 1985-1986[q,z]	85	-.21**	-.02	56	-.47***	-.16	56	-.06	.13
University: Learning Resources									
Percentage of Graduate Students (FTE): 1974[h]	85	-.09	.09	56	.09	.22	59	.26**	.17
Percentage of Graduate Students (FTE): 1978[i]	84	-.10	.02	56	.08	.26*	59	.27**	.19
Percentage of Graduate Students (FTE): 1982[j]	83	-.16	-.04	55	.02	.20	58	.28**	.18

Table 5 (Continued)

Variable	Chemistry N	Chemistry Zero-order	Chemistry Semi-partial	English N	English Zero-order	English Semi-partial	Psychology N	Psychology Zero-order	Psychology Semi-partial
Percentage of Graduate Students (FTE): 1986[k]	85	-.18*	-.04	57	.01	.22	61	.18	.09
Ratio of Volumes to Students (FTE): 1976-1977[u]	43	-.25	-.08	27	-.29	.17	21	.14	.32
Ratio of Volumes to Students (FTE): 1979-1980[v]	53	-.22	-.06	33	-.38**	-.02	29	.08	.37*
Ratio of Volumes to Students (FTE): 1982-1983[w]	51	-.24*	-.08	31	-.08	.22	28	-.04	.09
Ratio of Volumes to Students (FTE): 1985-1987[x,aa]	49	-.21	-.05	27	-.07	.18	26	.03	.15
Ratio of Current Periodicals to Students (FTE): 1976-1977[u]	43	-.22	-.09	27	-.15	.42**	21	.26	.43*
Ratio of Current Periodicals to Students (FTE): 1979-1980[v]	53	-.21	-.02	33	-.39**	.04	29	.19	.42**
Ratio of Current Periodicals to Students (FTE): 1982-1983[w]	51	-.20	-.05	31	-.01	.44**	28	.06	.13
Ratio of Current Periodicals to Students (FTE): 1985-1987[x,aa]	49	-.24*	-.09	27	-.04	.34	26	.11	.17
				University: Financial Assistance					
Nonresident Tuition: 1971-1972[a,y]				49	-.03	.17			
Nonresident Tuition: 1974-1975[b]	66	-.14	.09	44	-.13	.05	41	-.18	-.12
Nonresident Tuition: 1978-1979[c]	64	-.15	.11	39	-.19	.10	41	-.21	-.14

Table 5 (Continued)

Variable	Chemistry N	Chemistry Zero-order	Chemistry Semi-partial	English N	English Zero-order	English Semi-partial	Psychology N	Psychology Zero-order	Psychology Semi-partial
Nonresident Tuition: 1982-1983[d]	52	-.24*	.04	32	-.37**	-.20	35	-.12	-.11
Nonresident Tuition: 1986-1987[e]	50	-.18	.13	37	-.25	-.08	30	-.03	.00

[a]GRE/CGS Graduate Programs and Admissions Manual [1972-1973].

[b]GRE/CGS Graduate Programs and Admissions Manual--1975-1976.

[c]GRE/CGS Graduate Programs and Admissions Manual--1979-1981.

[d]GRE/CGS Directory of Graduate Programs: 1984 & 1985.

[e]GRE/CGS Directory of Graduate Programs: 1988 & 1989.

[f]Jones et al. (1982) An Assessment of Research-Doctorate Programs in the United States.

[g]NCES HEGIS V: Opening Fall Enrollment in Higher Education (Supplement), 1970.

[h]NCES HEGIS IX: Opening Fall Enrollment in Higher Education, 1974.

[i]NCES HEGIS XIII: Fall Enrollment and Compliance Report of Institutions of Higher Education, 1978.

[j]NCES HEGIS XVII: Fall Enrollment and Compliance Report of Institutions of Higher Education, 1982.

[k]CS IPEDS: Fall Enrollment, 1986.

[l]AAUP AAUP Bulletin, 1971.

[m]AAUP AAUP Bulletin, 1974.

[n]AAUP AAUP Bulletin, 1977.

[o]AAUP Academe, 1980.

[p]AAUP Academe, 1983.

Table 5 (Continued)

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[q]AAUP Academe, 1986.

[r]Carnegie Commission on Higher Education A Classification of Institutions of Higher Education, 1973.

[s]Carnegie Council on Policy Studies in Higher Education A Classification of Institutions of Higher Education, 1976.

[t]Carnegie Foundation for the Advancement of Teaching A Classification of Institutions of Higher Education, 1987.

[u]ARL. ARL Statistics--1976-1977.

[v]ARL. ARL Statistics--1979-80.

[w]ARL. ARL Statistics--1982-83.

[x]ARL. ARL Statistics--1985-86.

[y]This variable is only available for English.

[z]The sum of the averages for Assistant Professor, Associate Professor, and Professor.

[aa]This is the volume or periodicals data for 1985-1986 and the student data for 1986-1987.

*p < .10, two-tailed;** p < .05, two-tailed;*** p < .01, two-tailed.

Table 6

Institutional Characteristics Available for Selected Disciplines: Correlations with Time to Doctorate for Chemistry, English, and Psychology Departments

Variable	Chemistry N	Chemistry Zero-order	Chemistry Semi-partial	English N	English Zero-order	English Semi-partial	Psychology N	Psychology Zero-order	Psychology Semi-partial
Department: Size									
Common Field: 1974-1975[a,r]	72	.00	-.01				45	.06	-.04
Common Field: 1978-1979[b,r]	82	.13	-.02				55	.12	.01
Common Field: 1982-1983[c,r]	81	-.05	-.15				55	.03	-.02
Common Field: 1986-1987[d,r]	76	.01	-.15				46	.13	.01
Department: Selectivity									
Masters Students Admitted: 1986-1987[h]							51	.20	.27*
Number of Admissions Requirements of High Importance: 1973-1974[e]							52	.10	.02
Number of Admissions Requirements of High Importance: 1977-1978[f]							59	.07	-.01
Number of Admissions Requirements of High Importance: 1982-1983[g]							59	.08	-.01
Number of Admissions Requirements of High Importance: 1986-1987[h]							49	.05	.04
Number of Kinds of Undergraduate Courses Required: 1973-1974[e]							60	.02	-.02
Number of Kinds of Undergraduate Courses Required: 1977-1978[f]							59	-.02	-.15

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Table 6 (Continued)

Variable	Chemistry N	Chemistry Zero-order	Chemistry Semi-partial	English N	English Zero-order	English Semi-partial	Psychology N	Psychology Zero-order	Psychology Semi-partial
Number of Kinds of Undergraduate Courses Required: 1981-1982[g]							59	.07	-.17
Number of Kinds of Undergraduate Courses Required: 1986-1987[h]							54	.09	-.11
Department: Requirements									
Number of Requirements for Doctorate: 1973-1974[e]							58	.00	-.14
Number of Requirements for Doctorate: 1977-1978[f]							59	.15	.07
Number of Requirements for Doctorate: 1981-1982[g]							59	-.04	.04
Number of Requirements for Doctorate: 1986-1987[h]							53	-.07	-.17
Number of Credit Hours for Doctorate: 1986[j]				47	.30**	-.01			
Department: Faculty Availability									
Faculty Classroom Hours per Week[i,l,s]				32	.27	.04	43	.11	-.02
Ratio of Undergraduate Majors Graduating to Faculty (FT)[i,k,t]				35	-.47***	-.35*	36	-.04	-.17
Percentage of Instructors and Assistant Professors (FT Tenure Track)[i,k,u]				36	-.13	.02	36	-.16	-.07

Table 6 (Continued)

Variable	Chemistry N	Chemistry Zero-order	Chemistry Semi-partial	English N	English Zero-order	English Semi-partial	Psychology N	Psychology Zero-order	Psychology Semi-partial
Department: Faculty Quality									
Number of Articles Attributed to Program: 1978-1979[m]	86	-.25**	-.02				61	-.23*	-.08
Percentage of Faculty With Articles, 1978-1980[m]							60	-.28**	-.07
Influence of Articles Attributed to Program: 1978-1979[m]	86	-.26**	.03				61	-.30**	.00
Percentage of Faculty with Doctorates (FT Tenure Track)[i,k,u]				34	.19	.25	36	-.32*	-.21
Department: Learning Resources									
Year Founded[g]							60	.17	.22*
Years Awarding Doctorate: 1986[j]				52	-.20	.15			
Ratio of Clerical Staff (FTE) to Faculty (FT): 1984-1985[k]							42	-.29*	-.10
Ratio of Instructional and Research Equipment Budget to Students (FTE): 1984-1985[k,v]							40	-.05	-.08
Department: Research Resources									
Percentage of Faculty with Research Grants: 1978-1980[m]	86	-.35***	.06				60	-.27**	.03
Amount of Research and Development Expenditures for Discipline: 1974-1975[n,w]	53	-.28**	.08				36	-.13	.11

Table 6 (Continued)

Variable	Chemistry N	Chemistry Zero-order	Chemistry Semi-partial	English N	English Zero-order	English Semi-partial	Psychology N	Psychology Zero-order	Psychology Semi-partial
Amount of Research and Development Expenditures for Discipline: 1977-1978[o,w]	56	-.20	.10				31	.20	.25
Amount of Research and Development Expenditures for Discipline: 1980-1981[p,w]	59	-.16	.22*				34	-.03	.12
Amount of Research and Development Expenditures for Discipline: 1983-1984[p,w]	59	-.14	.31**				34	.05	.19
Amount of Research and Development Expenditures for Discipline: 1986-1987[q,w]	59	-.12	.22*				36	-.06	.12
Ratio of Research Support Staff (FTE) to Faculty (FT): 1984-1985[k]							39	-.08	.22
Ratio of External Research Funds to Faculty (FT): 1985[k,x]							40	-.16	.09
Department: Financial Assistance									
Admit Doctoral Students Without Support: 1986-1987[l]							44	.24	.34**
Maximum Support Offered Doctoral Students: 1986-1987[l]							44	-.16	.02
Average Assistantship Hours: 1973-1974[e,y]							35	-.12	-.19
Average Assistantship Hours: 1977-1978[f,y]							32	-.18	-.18
Average Assistantship Hours: 1981-1982[g,y]							22	-.14	.07

Table 6 (Continued)

Variable	Chemistry N	Chemistry Zero-order	Chemistry Semi-partial	English N	English Zero-order	English Semi-partial	Psychology N	Psychology Zero-order	Psychology Semi-partial
Average Assistantship Hours: 1986-1987[h,y]							44	-.15	-.07
Average Assistantship Stipend: 1986-1987[h,y]							45	-.29*	-.24

[a]GRE/CGS Graduate Programs and Admissions Manual--1975-1976.

[b]GRE/CGS Graduate Programs and Admissions Manual--1979-1981.

[c]GRE/CGS Directory of Graduate Programs: 1984 & 1985.

[d]GRE/CGS Directory of Graduate Programs: 1988 & 1989.

[e]APA Graduate Study is Psychology and Associated Fields--1974.

[f]APA Graduate Study is Psychology and Associated Fields--1978.

[g]APA Graduate Study is Psychology and Associated Fields--1982.

[h]APA Graduate Study is Psychology and Associated Fields--1986.

[i]MLA English Programs Survey, 1983-1984.

[j]MLA English Doctoral Programs Survey, 1986.

[k]APA/COGDOP Survey of Graduate Departments of Psychology, 1985-1986.

[l]APA/COGDOP Survey of Graduate Departments of Psychology, 1986-1987.

[m]Jones et al. (1982) An Assessment of Research-Doctorate Programs in the United States.

[n]NSF Expenditures for Scientific Activities at Universities and Colleges, Fiscal Year 1977.

Table 6 (Continued)

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[q]NSF Academic Science R & D Funds, Fiscal Year 1980.

[r]NSF Academic Science/Engineering: R & D Funds, Fiscal Year 1983.

[s]NSF Academic Science/Engineering: R & D Funds, Fiscal Year 1987.

[t]The common field is Organic for Chemistry and Clinical for Psychology.

[u]This variable is for 1983-1984 for English and 1986-1987 for Psychology. Academic-year data for Psychology have been prorated on a semester basis.

[v]This variable is for 1983-1984 for English and 1984-1986 for Psychology (undergraduate majors in 1984-1985 and faculty in 1985-1986).

[w]This variable is for 1983-1984 for English and 1985-1986 for Psychology.

[x]This variable is based on the budget in 1984-1985 and the students in 1985-1986.

[y]In thousands.

[z]This variable is based on the funds in 1985 and the faculty in 1985-1986.

[aa]The sum of the averages for teaching assistantships and research assistantships.

Figure Captions

Figure 1. Scatterplot for Department: Amount of Research and Development Expenditures for Discipline--1980-1981 with Median Years from First Enrollment in Graduate School to Graduation (Adjusted), Chemistry.

Figure 2. Scatterplot for Department: Amount of Research and Development Expenditures for Discipline--1983-1984 with Median Years from First Enrollment in Graduate School to Graduation (Adjusted), Chemistry.

Figure 3. Scatterplot for Department: Amount of Research and Development Expenditures for Discipline--1986-1987 with Median Years from First Enrollment in Graduate School to Graduation (Adjusted), Chemistry.

Figure 4. Scatterplot for University: Ratio of Current Periodicals to Students--1976-1977 with Median Years from First Enrollment in Graduate School to Graduation (Adjusted), English.

Figure 5. Scatterplot for University: Ratio of Current Periodicals to Students--1982-1983 with Median Years from First Enrollment in Graduate School to Graduation (Adjusted), English.

Figure 6. Scatterplot for Department: Ratio of Undergraduate Majors Graduating to Faculty to Median Years from First Enrollment in Graduate School to Graduation (Adjusted), English.

Figure 7. Scatterplot for Department: Number of Students--1974-1975 with Median Years from First Enrollment in Graduate School to Graduation (Adjusted), Psychology.

Figure 8. Scatterplot for Department: Number of Students--1978-1979 with Median Years from First Enrollment in Graduate School to Graduation (Adjusted), Psychology.

Figure 9. Scatterplot for Department: Number of Students--1982-1983 with Median Years from First Enrollment in Graduate School to Graduation (Adjusted), Psychology.

Figure 10. Scatterplot for Department: Number of Students--1986-1987 with Median Years from First Enrollment in Graduate School to Graduation (Adjusted), Psychology.

Figure 11. Scatterplot for Department: Ratio of Students to Faculty--1974-1975 with Median Years from First Enrollment in Graduate School to Graduation (Adjusted), Psychology.

Figure 12. Scatterplot for Department: Ratio of Students to Faculty--1986-1987 with Median Years from First Enrollment in Graduate School to Graduation (Adjusted), Psychology.

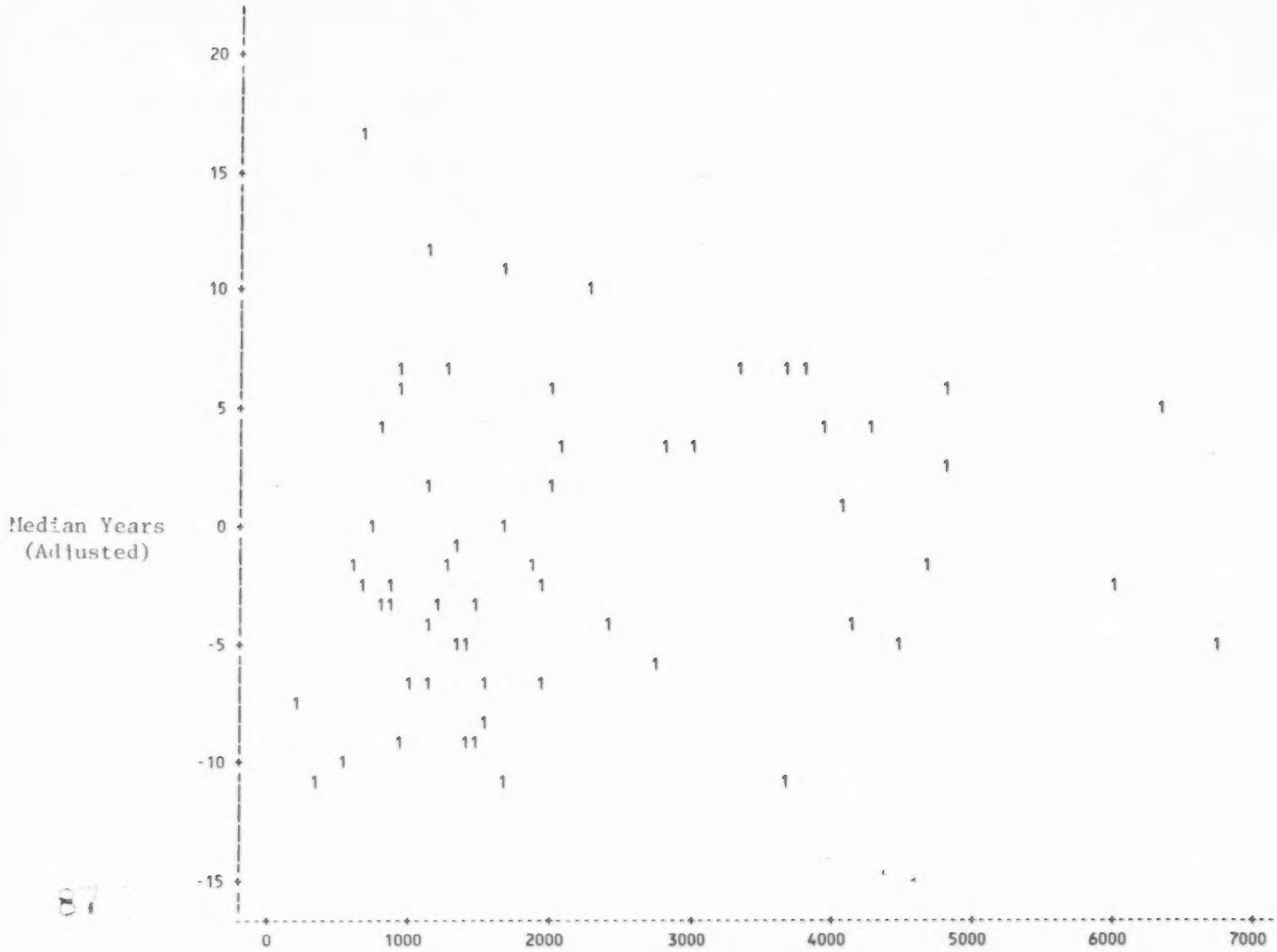
Figure 13. Scatterplot for University: Ratio of Current Periodicals to Students--1976-1977 with Median Years from First Enrollment in Graduate School to Graduation (Adjusted), Psychology.

Figure 14. Scatterplot for University: Ratio of Current Periodicals to Students--1979-1980 with Median Years from First Enrollment in Graduate School to Graduation (Adjusted), Psychology.

Figure 15. Scatterplot for Department: Masters Students Admitted--1986-1987 with Median Years from First Enrollment in Graduate School to Graduation (Adjusted), Psychology.

Figure 16. Scatterplot for Department: Year Founded with Median Years from First Enrollment in Graduate School to Graduation (Adjusted), Psychology.

Figure 17. Scatterplot for Department: Admit Doctoral Students without Support--1986-1987 with Median Years from First Enrollment in Graduate School to Graduation (Adjusted), Psychology.


Median Years
(Adjusted)
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10
5
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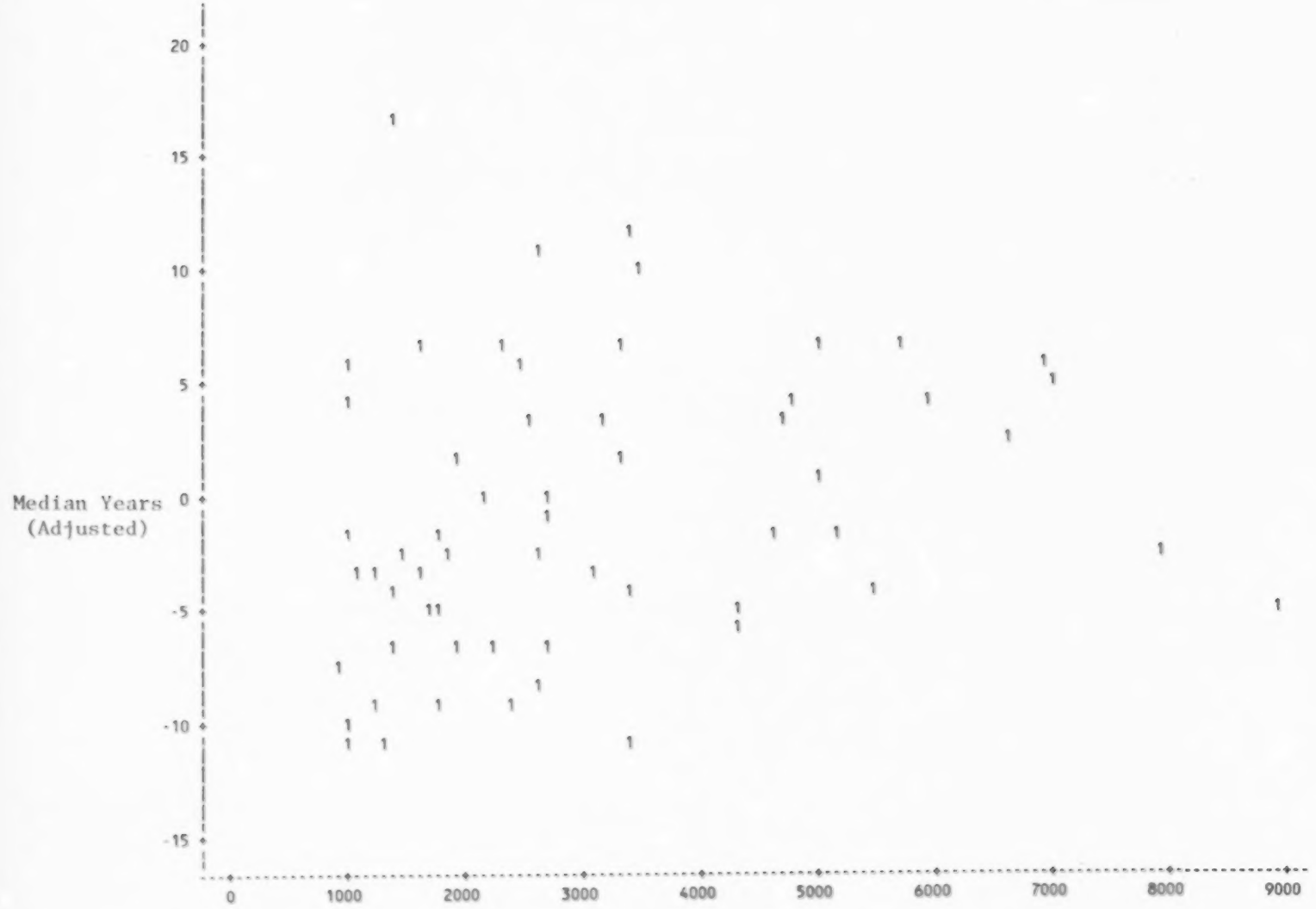
-5
-10
-15
0
1000
2000
3000
4000
5000
6000
7000
Research and Development Expenditures--1980-1981


Median Years
(Adjusted)
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15
10
5
0
-5
-10
-15
0
1000
2000
3000
4000
5000
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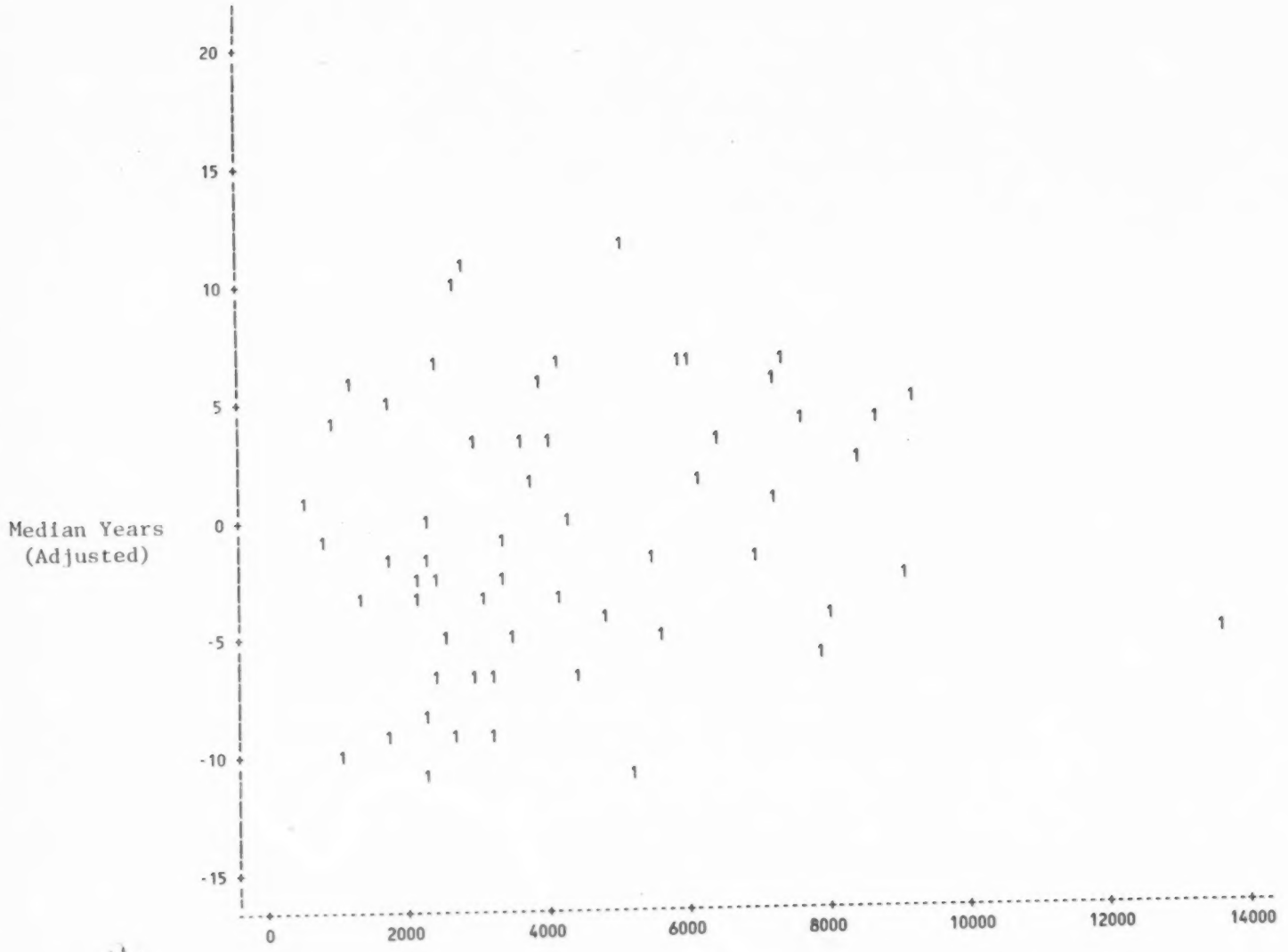
7000
8000
9000
Research and Development Expenditures--1983-1984


Median Years
(Adjusted)
20
15
10
5
0
-5
-10
-15
0
2000
4000
6000
8000
10000
12000
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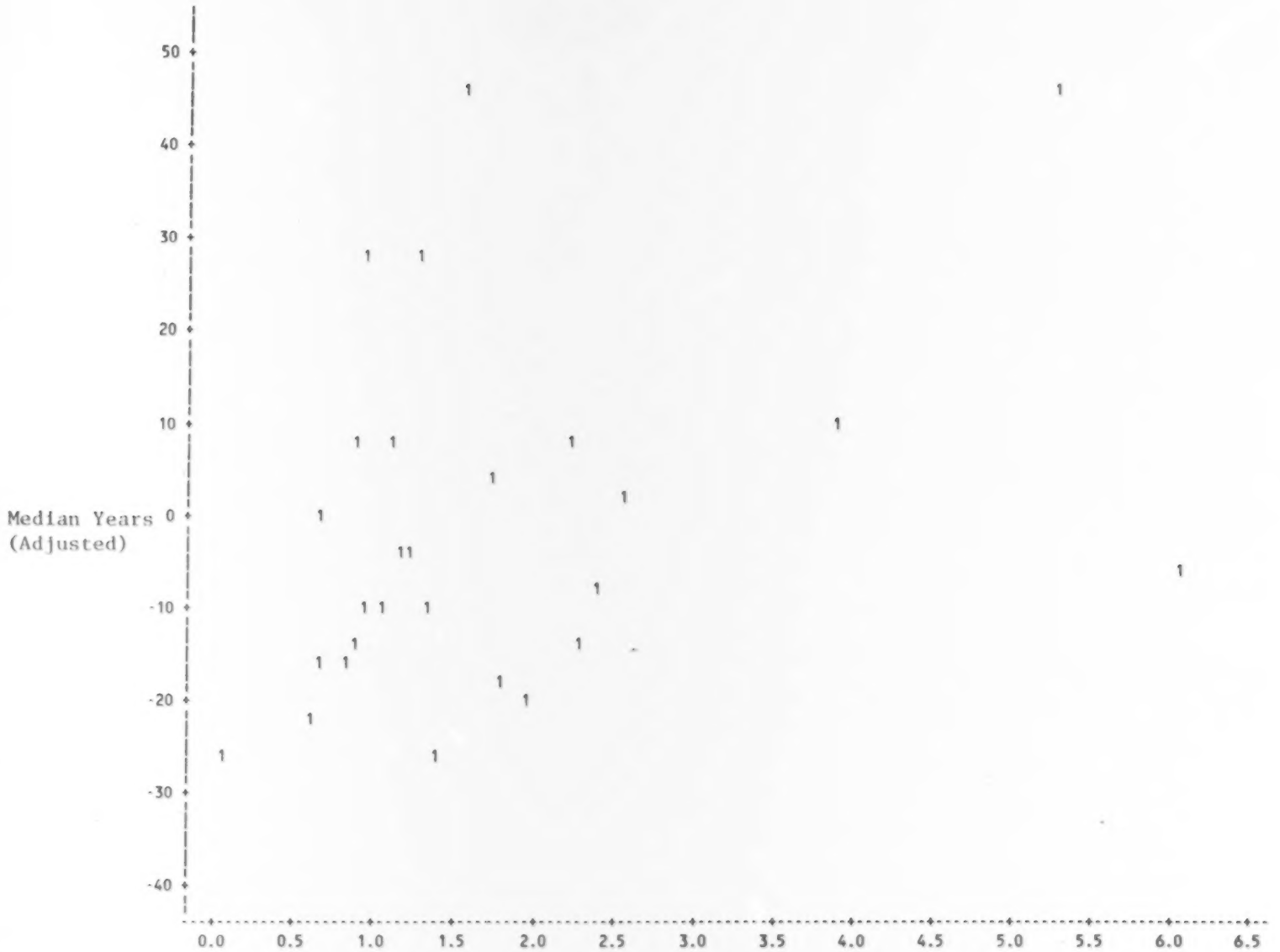
Research and Development Expenditures--1986-1987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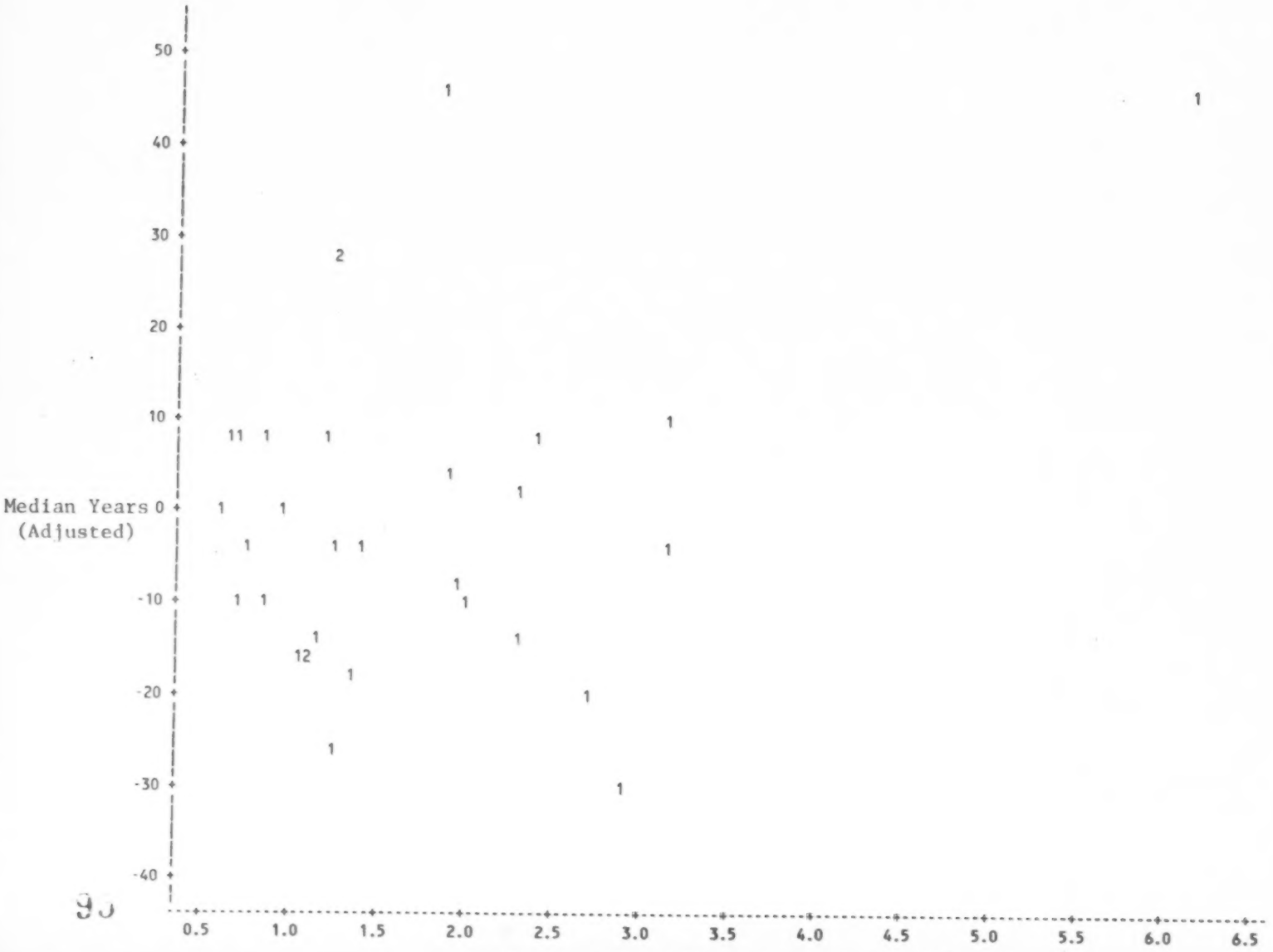
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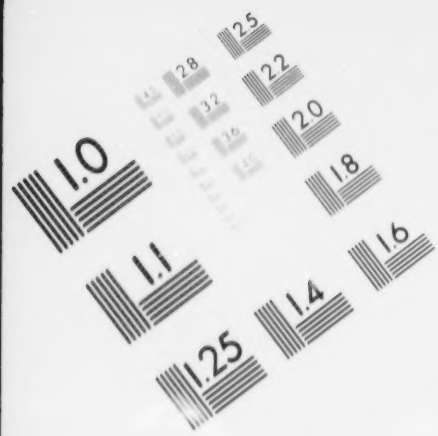
Ratio of Periodicals to Students--1982-1983



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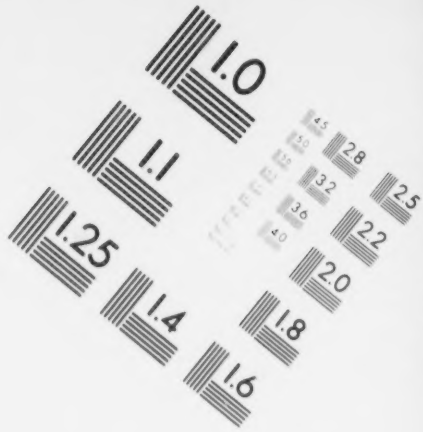

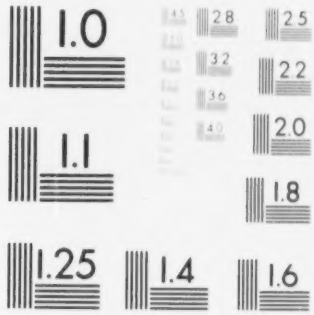

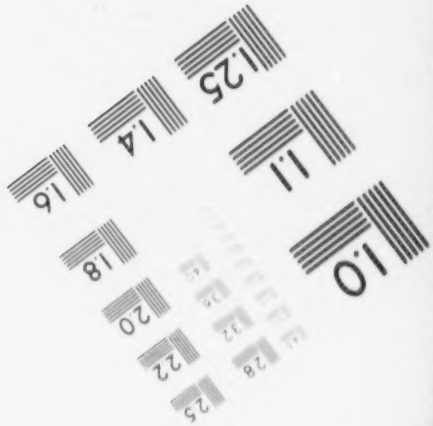

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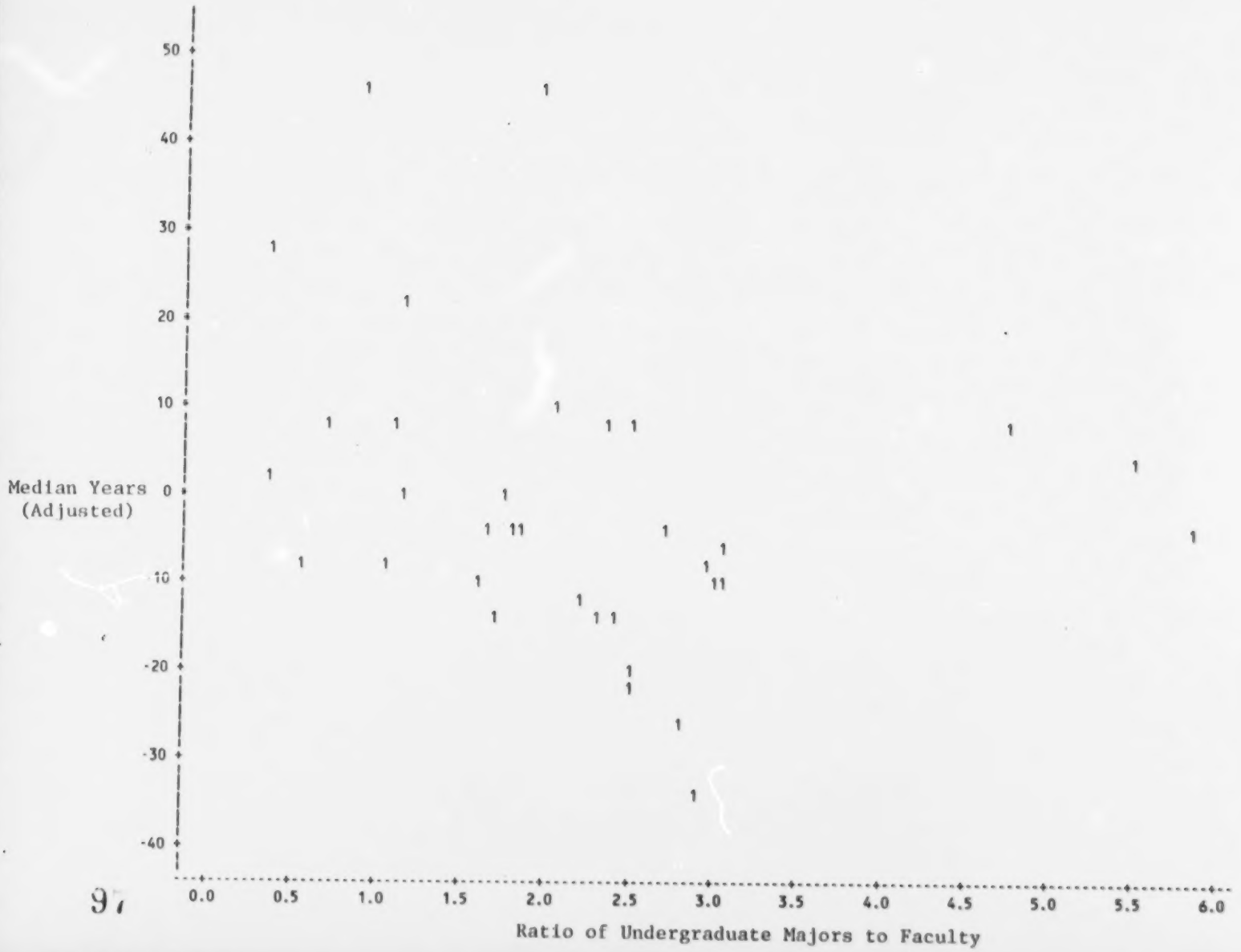
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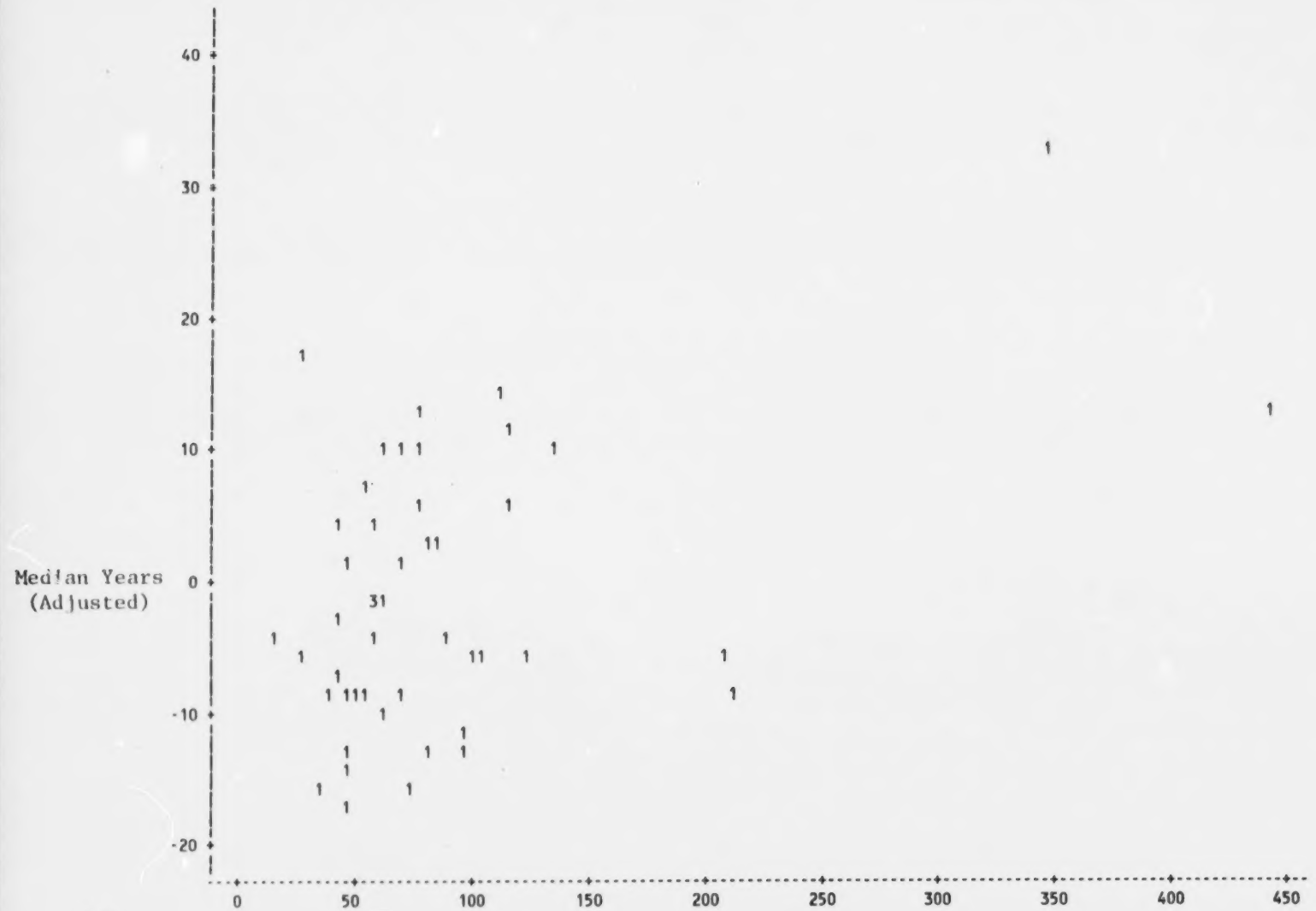
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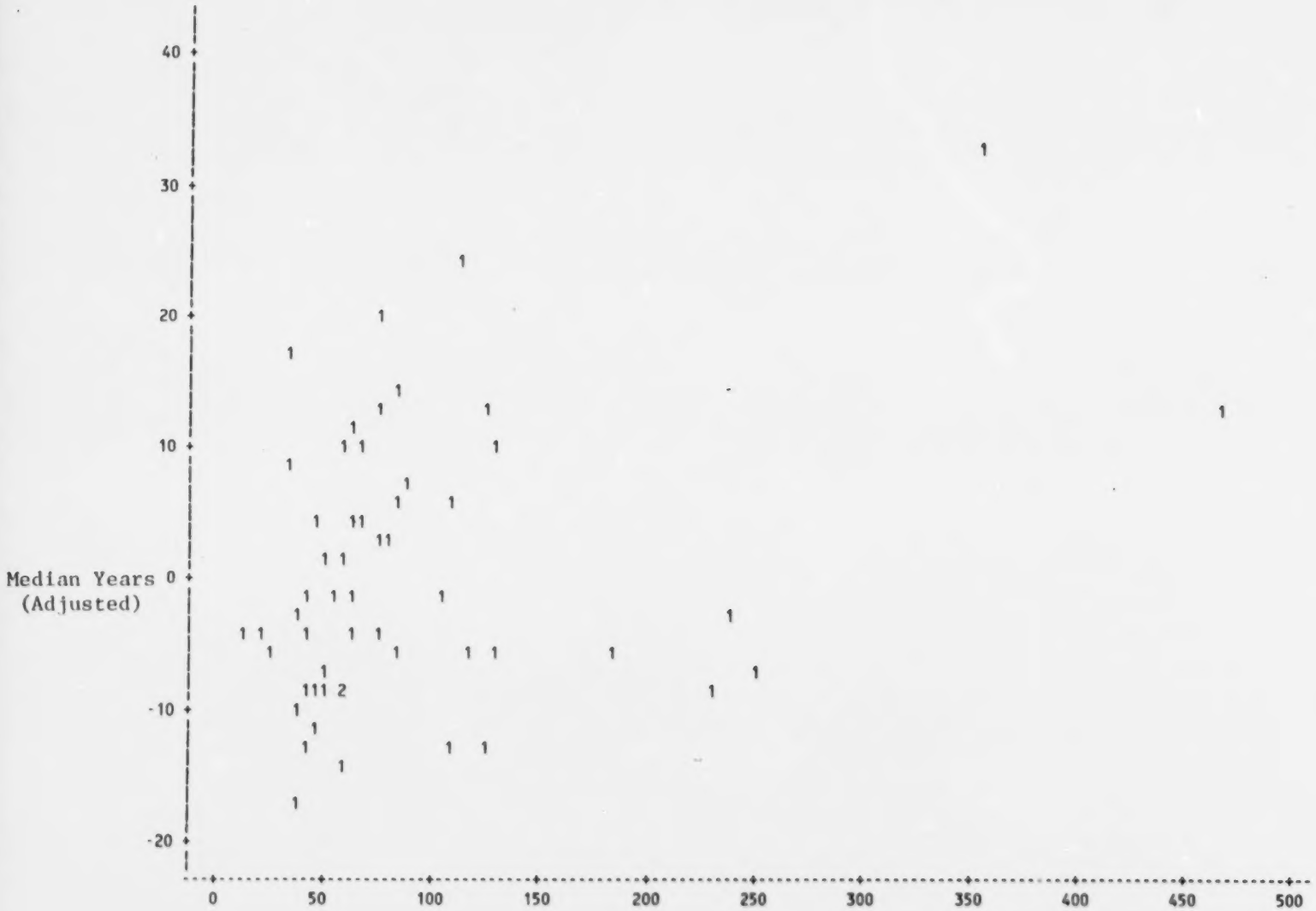
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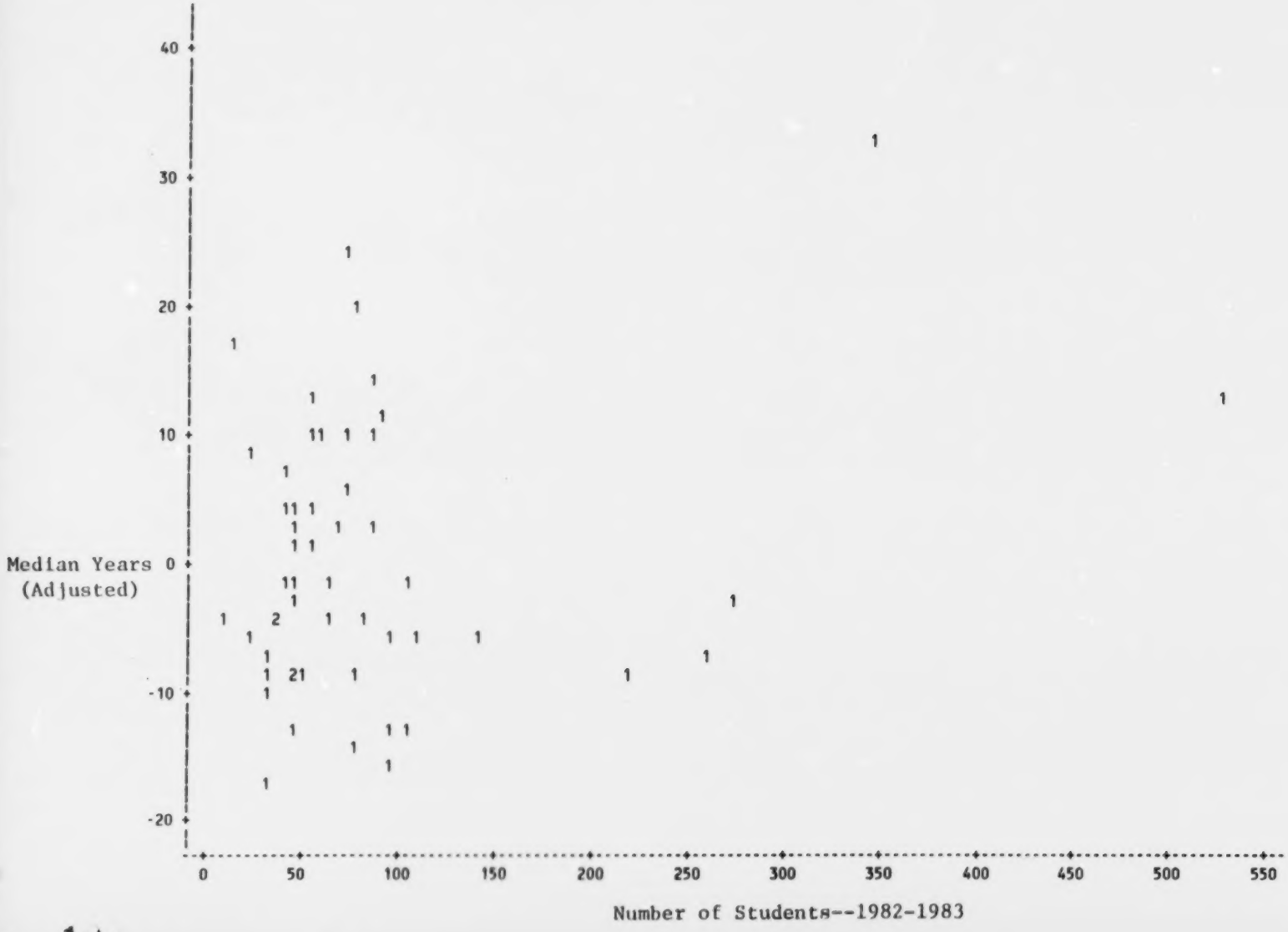
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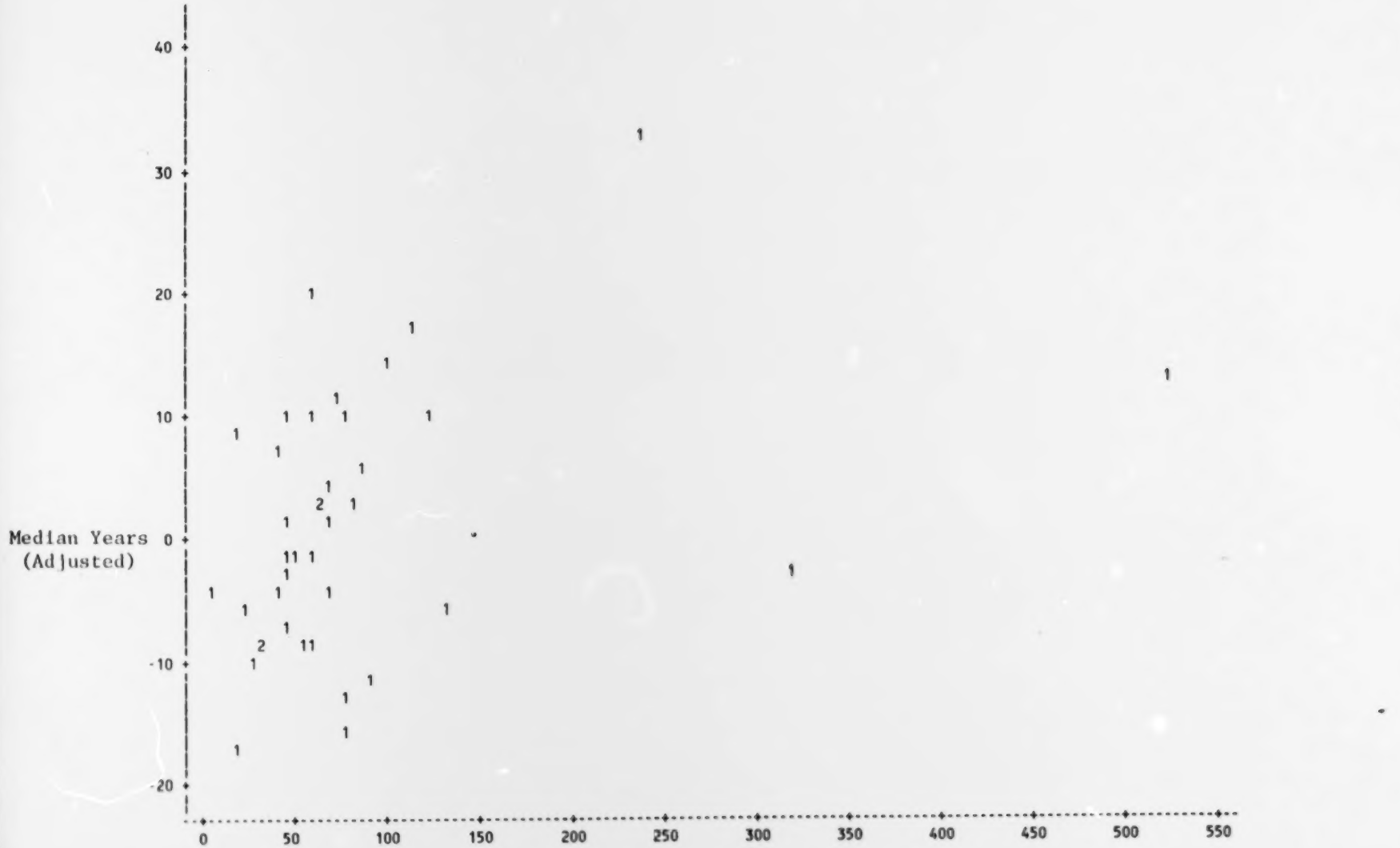
Number of Students--1982-1983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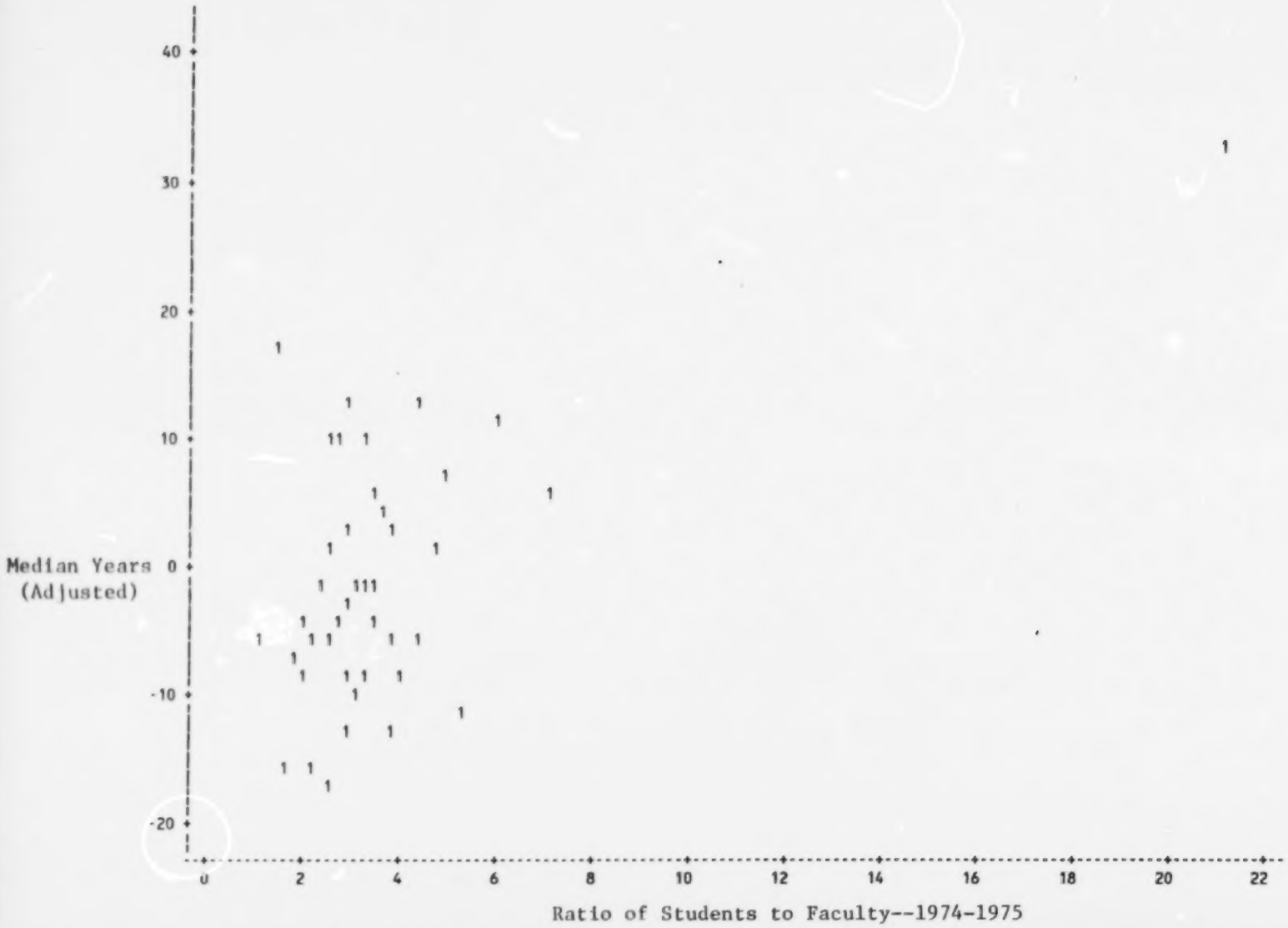
Number of Students--1986-1987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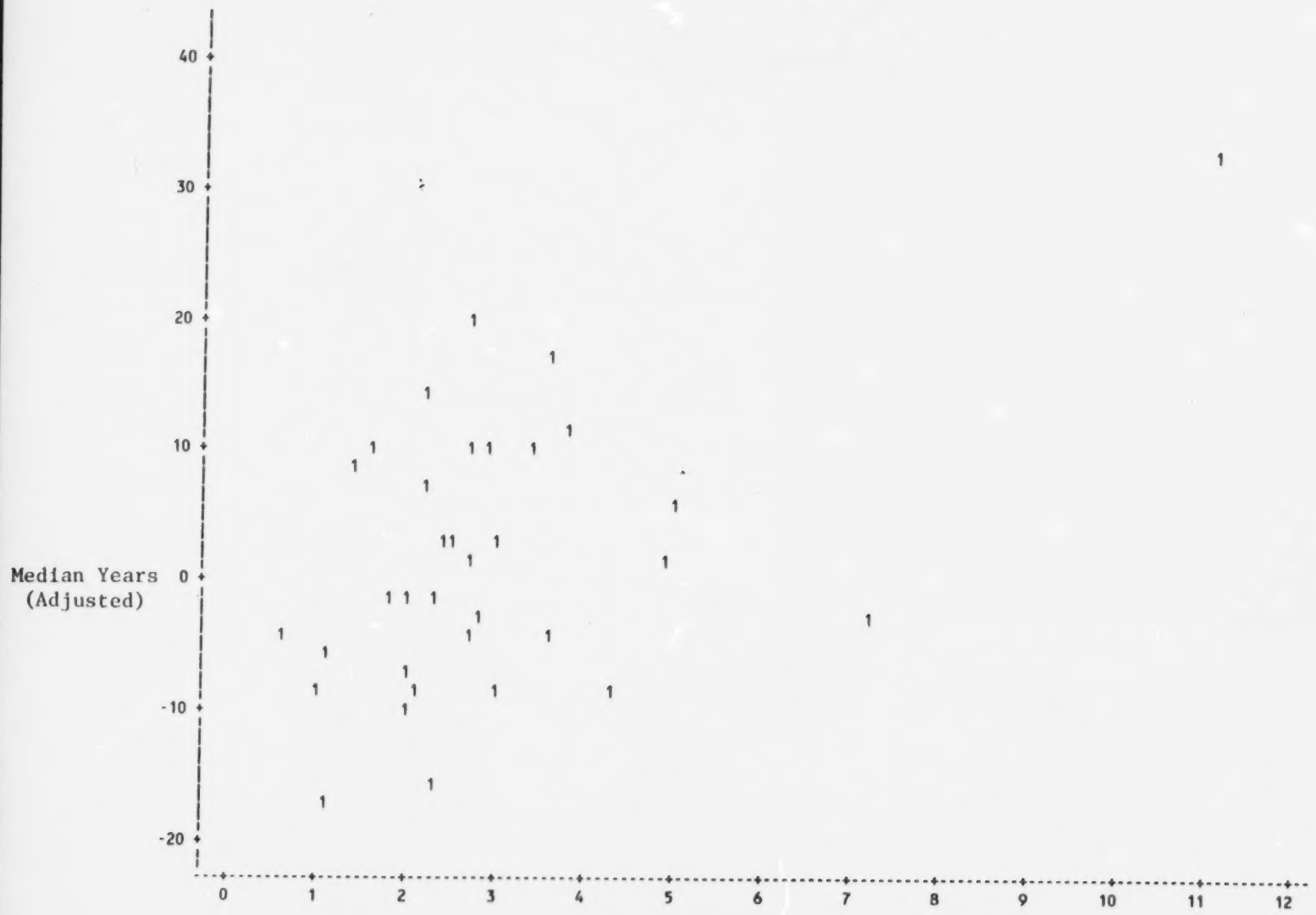
Ratio of Students to Faculty--1974-1975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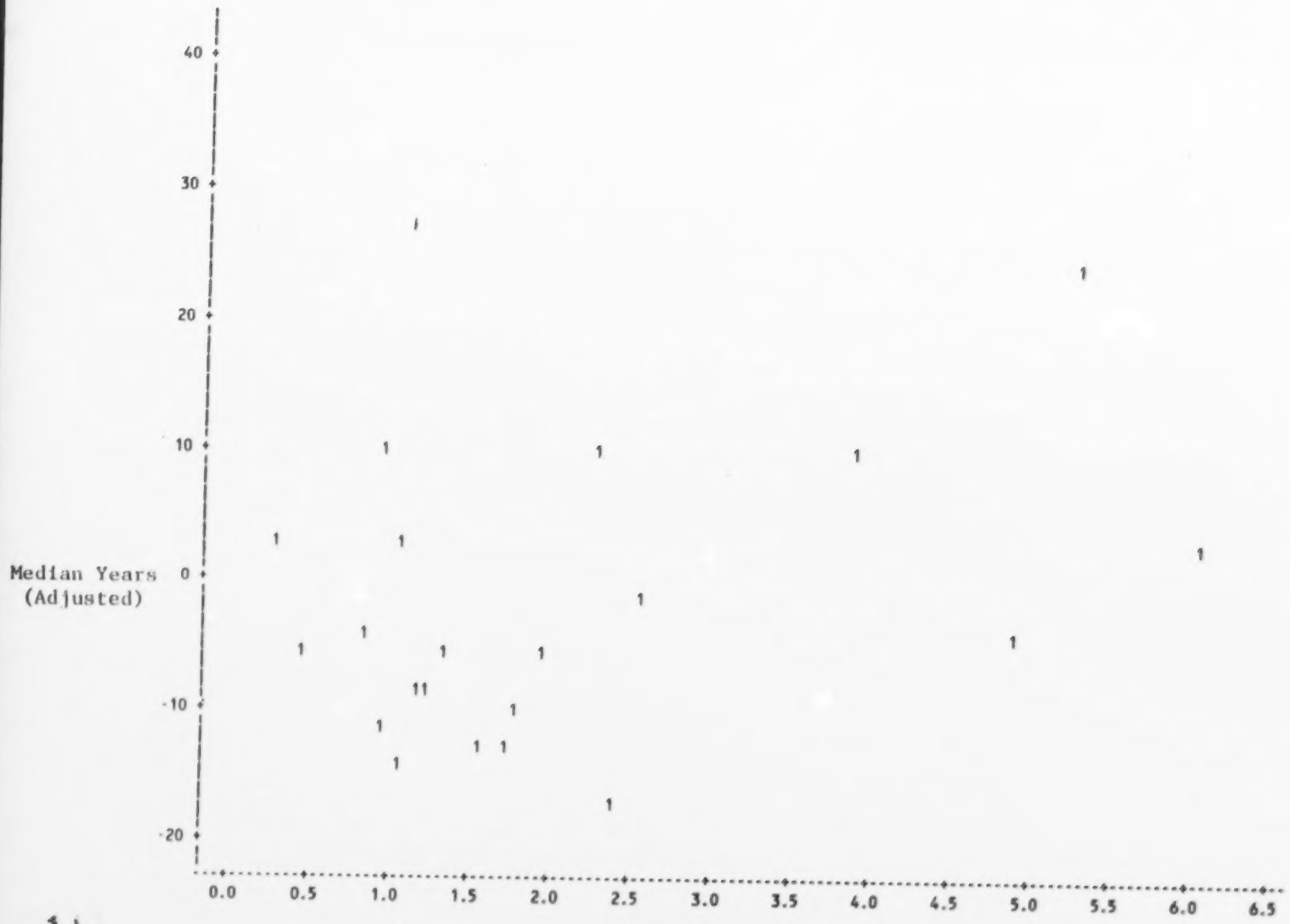
Ratio of Students to Faculty--1986-1987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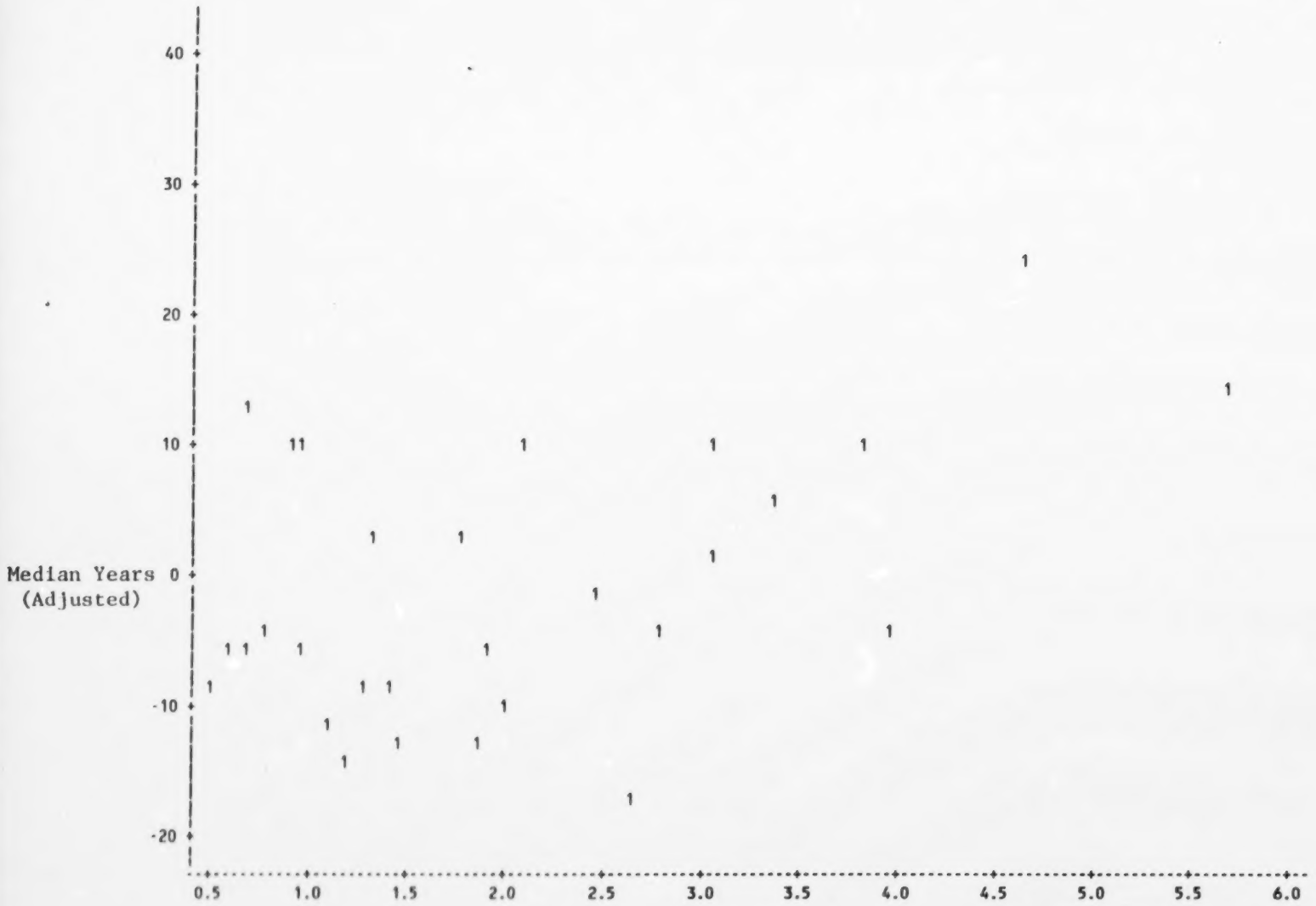
Ratio of Periodicals to Students--1976-1977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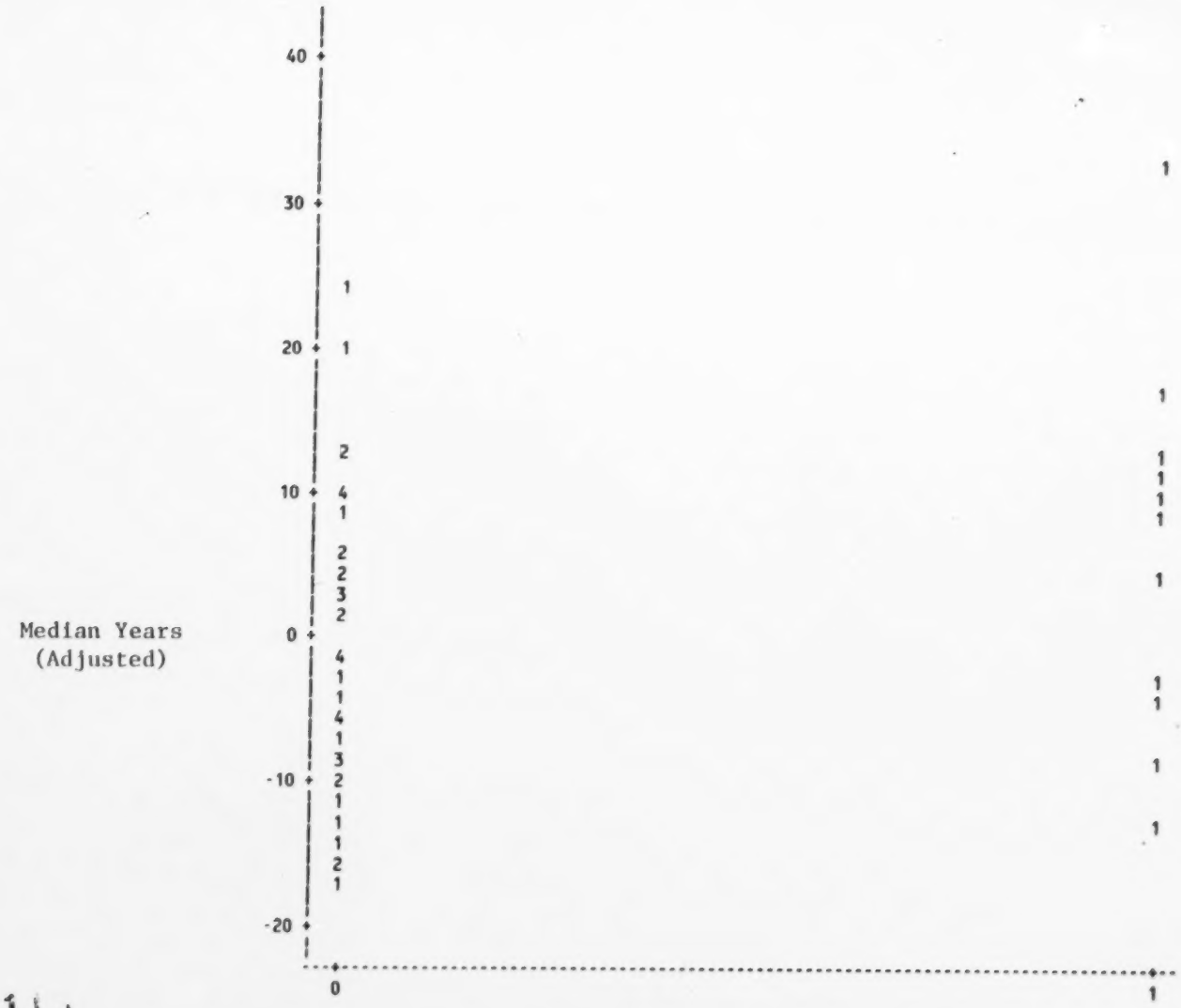
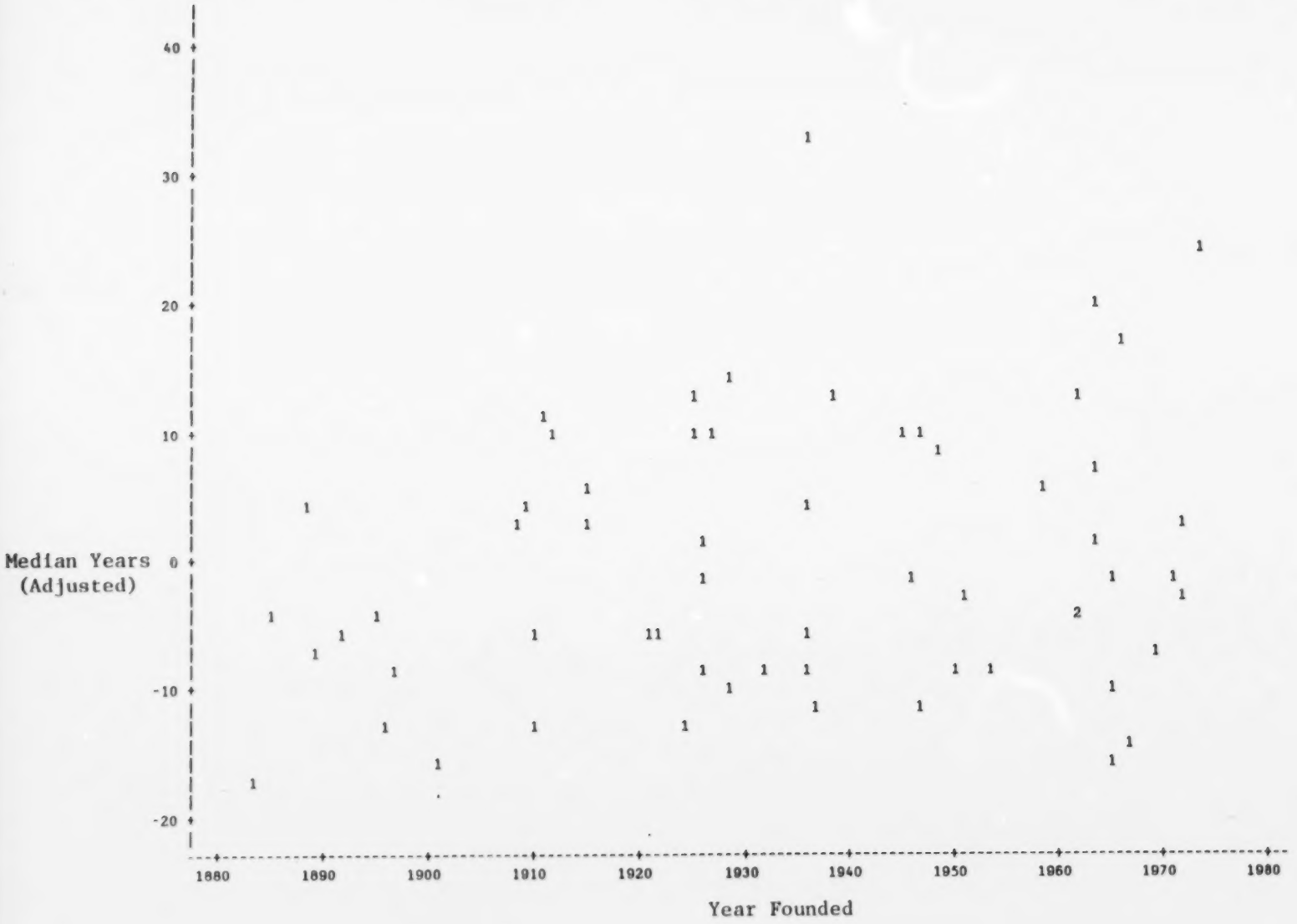
Ratio of Periodicals to Students--1979-1980



Masters Students Admitted--1986-1987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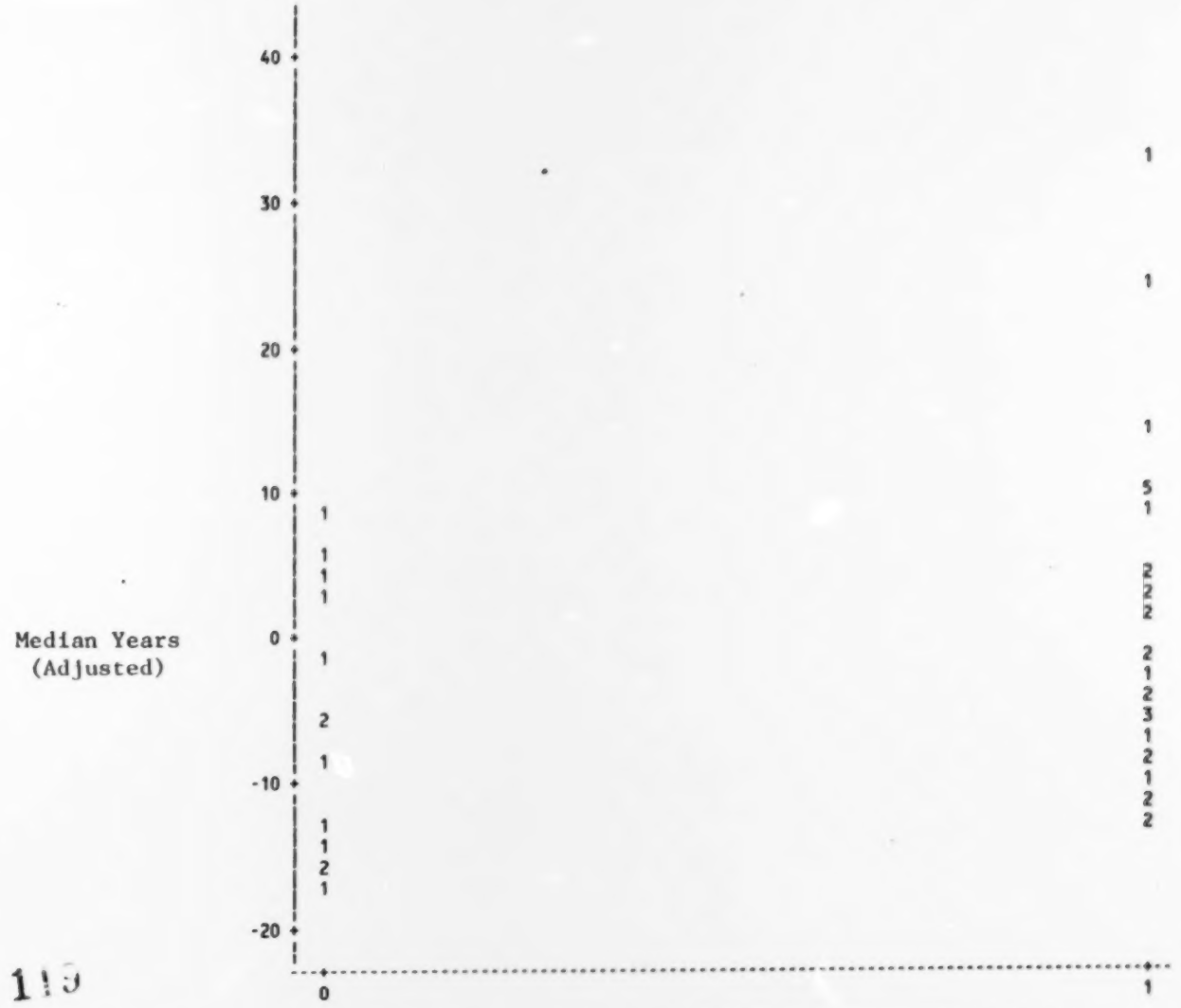
1980
Year Founded



Admit Doctoral Students Without Support--1986-1987

Appendix

Table A-1

Number of Graduates in Survey of Earned Doctorates Subfields that Define Chemistry, English, and Psychology

Subfield	Number of Graduates
Chemistry	
Analytical	748
General	747
Inorganic	743
Nuclear	51
Organic	1,530
Physical	1,015
Polymer	205
Theoretical	143
Other Chemistry	235
Total	5,417
English	
American Literature	511
English Literature	1,170
English Language	68
General Letters	43
Other Letters	70
Total	1,862
Psychology	
Clinical	1,863
Cognitive	185
Comparative	16

Table A-1 (continued)

Subfield	Number of Graduates
Developmental	270
Experimental	270
General	407
Industrial and Organizational	142
Personality	39
Physiological	145
Psychometric	19
Quantitative	26
Social	286
Other Psychology	209
Total	3,877

Table A-2

Student Characteristics and Time to Doctorate: Means and Standard Deviations for Chemistry, English, and Psychology Departments

Variable	Chemistry N	Chemistry Mean	Chemistry S.D.	English N	English Mean	English S.D.	Psychology N	Psychology Mean	Psychology S.D.
Demographic									
Percentage of Women	86	20.30	9.06	57	57.97	12.93	62	51.16	9.85
Percentage of Whites	85	72.45	16.01	56	92.21	6.52	62	90.72	5.58
Percentage of Citizens	86	72.26	16.59	57	91.79	6.87	62	94.59	4.70
Percentage with College-Educated Fathers	85	58.05	13.07	56	60.15	14.20	62	63.91	9.17
Undergraduate Institution									
Average College Selectivity: 1973-1974	78	1,055.13	68.32	55	1,072.80	68.70	62	1,091.29	58.00
Percentage with High Ph.D. Productivity Ratio: All Fields: 1974-1976	86	10.13	11.05	57	15.86	13.44	62	18.50	12.35
Percentage with Research Doctorate Universities: 1976	79	32.41	16.31	54	31.67	14.08	62	42.77	13.85
Percentage with Publicly Controlled Universities: 1976-1977	79	53.02	16.51	55	45.58	19.82	62	51.76	16.33

Table A-2 (Continued)

Variable	Chemistry N	Chemistry Mean	Chemistry S.D.	English N	English Mean	English S.D.	Psychology N	Psychology Mean	Psychology S.D.
Graduate Career									
Percentage with Competitive Fellowships	86	5.83	5.80	57	5.38	7.66	62	5.70	8.18
Percentage Entering Graduate School Immediately After College	86	66.71	13.45	57	52.52	11.03	62	54.28	10.44
Percentage Not Transferring from Another Graduate Program	86	75.45	14.06	57	38.34	11.65	62	53.09	11.24
Percentage with Undergraduate Degree in Same Field	86	87.87	7.25	57	80.41	7.13	62	75.59	10.89
Percentage in Common Graduate Field	86	27.15	11.51	57	62.94	15.28	62	41.40	30.83
Median Years from First Enrollment in Graduate School to Graduation	86	6.09	.99	57	10.91	2.44	62	7.50	1.43

Table A-3

Institutional Characteristics Available for All Disciplines: Means and Standard Deviations for Chemistry, English, and Psychology Departments

Variable	Chemistry N	Chemistry Mean	Chemistry S.D.	English N	English Mean	English S.D.	Psychology N	Psychology Mean	Psychology S.D.
			Department:	Size					
Number of Faculty (FTE): 1971-1972				36	30.98	17.80			
Number of Faculty (FTE): 1974-1975	57	23.74	9.38	43	36.37	20.74	42	25.93	22.76
Number of Faculty (FTE): 1978-1979	68	25.08	11.06	44	31.44	15.25	54	25.99	19.42
Number of Faculty (FTE): 1982-1983	70	25.35	12.68	46	32.99	15.02	50	24.22	9.59
Number of Faculty (FTE): 1986-1987	69	24.76	12.30	48	34.10	15.86	40	25.06	10.66
Number of Students (FTE): 1971-1972				47	112.71	79.84			
Number of Students (FTE): 1974-1975	69	75.02	52.44	50	95.06	61.07	48	87.17	76.03
Number of Students (FTE): 1978-1979	75	77.46	58.72	49	72.46	47.40	54	91.01	82.04
Number of Students (FTE): 1982-1983	75	86.71	63.31	52	70.03	53.33	53	85.52	89.04
Number of Students (FTE): 1986-1987	69	91.01	57.00	50	70.09	42.96	39	83.26	91.75
Number of Programs: 1971-1972				37	1.32	.47			
Number of Programs: 1974-1975	71	5.72	1.83	42	1.43	.50	45	4.78	1.86
Number of Programs: 1978-1979	77	5.18	2.50				55	3.89	1.88
Number of Programs: 1982-1983	79	5.89	2.46				55	4.20	1.79
Number of Programs: 1986-1987	76	6.03	2.61				46	4.26	1.83

Table A-3 (Continued)

Variable	Chemistry N	Chemistry Mean	Chemistry S.D.	English N	English Mean	English S.D.	Psychology N	Psychology Mean	Psychology S.D.
Department: Selectivity									
Number of Admission Requirements: 1982-1983	35	2.06	.94	28	2.29	1.18	24	2.92	1.25
Number of Admission Requirements: 1987-1987	40	2.22	1.05	29	2.48	1.21	21	2.81	1.29
Department: Requirements									
Foreign Language Required: 1982-1983	73	.77	.43	52	.92	.27	48	.38	.49
Foreign Language Required: 1986-1987	70	.66	.48	51	.94	.24	42	.38	.49
Part-Time Entering Students Allowed: 1971-1972				40	.85	.36			
Part-Time Entering Students Allowed: 1974-1975	65	.48	.50	45	.78	.42	41	.34	.48
Part-Time Entering Students Allowed: 1978-1979	70	.51	.50	44	.80	.41	47	.34	.48
Part-Time Entering Students Allowed: 1982-1983	71	.49	.50	47	.68	.47	46	.26	.44
Part-Time Entering Students Allowed: 1986-1987	63	.43	.50	46	.70	.47	34	.24	.43
Department: Faculty Availability									
Ratio of Students to Faculty (FTE): 1971-1972				34	3.81	1.80			

Table 2 (Continued)

Variable	Chemistry N	Chemistry Mean	Chemistry S.D.	English N	English Mean	English S.D.	Psychology N	Psychology Mean	Psychology S.D.
Ratio of Students to Faculty (FTE): 1974-1975	53	3.05	1.43	42	2.97	1.57	41	3.65	3.03
Ratio of Students to Faculty (FTE): 1978-1979	66	3.02	1.41	43	2.45	1.20	52	5.11	9.27
Ratio of Students to Faculty (FTE): 1982-1983	67	3.21	1.44	44	2.17	.94	49	3.48	3.68
Ratio of Students to Faculty (FTE): 1986-1987	63	3.92	3.83	46	2.20	.99	34	2.93	1.94
Percentage of Full-Time Faculty: 1971-1972				35	93.41	8.61			
Percentage of Full-Time Faculty: 1974-1975	57	93.19	9.01	43	91.62	9.18	41	83.54	17.73
Percentage of Full-Time Faculty: 1978-1979	68	94.12	9.25	44	93.30	10.90	53	81.88	23.49
Percentage of Full-Time Faculty: 1982-1983	70	92.73	10.67	46	94.07	8.96	49	82.85	19.33
Percentage of Full-Time Faculty: 1986-1987	67	93.89	8.74	48	91.91	10.36	39	79.41	21.48
Department: Faculty Quality									
Rating of Quality to Faculty: 1981	86	2.63	1.03	57	2.55	1.09	62	2.62	1.04

A-7

Table A-3 (Continued)

Variable	Chemistry N	Chemistry Mean	Chemistry S.D.	English N	English Mean	English S.D.	Psychology N	Psychology Mean	Psychology S.D.
Department: Learning Resources									
Rating of Program Effectiveness:1981	86	1.68	.55	57	1.56	.55	60	1.59	.54
Ratio of Available Teaching Assistantships to Faculty (FTE): 1971-1972				34	1.68	1.02			
Ratio of Available Teaching Assistantships to Faculty (FTE): 1974-1975	52	1.39	.68	39	1.15	.71	37	.76	.41
Ratio of Available Teaching Assistantships to Faculty (FTE): 1978-1979	68	1.48	.68	41	.99	.60	48	.71	.45
Ratio of Available Teaching Assistantships to Faculty (FTE): 1982-1983	68	1.53	.72	46	1.10	.67	48	.78	.80
Ratio of Available Teaching Assistantships to Faculty (FTE): 1986-1987	64	1.60	.59	47	1.17	.56	36	.74	.40
Department: Research Resources									
Ratio of Available Research Assistantships to Faculty (FT): 1971-1972				24	.17	.22			
Ratio of Available Research Assistantships to Faculty (FT): 1974-1975	72	.78	.69	35	.13	.28	43	.55	.55
Ratio of Available Research Assistantships to Faculty (FT): 1978-1979	78	1.08	.91	47	.07	.13	49	.47	.50
Ratio of Available Research Assistantships to Faculty (FT): 1982-1983	78	1.19	1.07	50	.07	.12	49	.32	.32
Ratio of Available Research Assistantships to Faculty (FT): 1986-1987	71	1.42	1.25	48	.06	.12	36	.41	.40

Table A-3 (Continued)

Variable	Chemistry N	Chemistry Mean	Chemistry S.D.	English N	English Mean	English S.D.	Psychology N	Psychology Mean	Psychology S.D.
Department: Financial Assistance									
Ratio of Available Fellowships and Assistantships to Students: 1971-1972				24	.62	.40			
Ratio of Available Fellowships and Assistantships to Students: 1974-1975	64	.85	.27	34	.49	.26	43	.67	.25
Ratio of Available Fellowships and Assistantships to Students: 1978-1979	74	.88	.23	48	.49	.19	52	.61	.45
Ratio of Available Fellowships and Assistantships to Students: 1982-1983	73	.89	.30	48	.62	.33	51	.55	.34
Ratio of Available Fellowships and Assistantships to Students: 1986-1987	65	.90	.21	47	.61	.22	37	.58	.26
University: Control									
University Control Public: 1970-1971				56	.52	.50			
University Control Public: 1974-1975	85	.65	.48	56	.52	.50	59	.53	.50
University Control Public: 1978-1979	86	.65	.48	57	.53	.50	61	.54	.50
University Control Public: 1982-1983	85	.66	.48	56	.54	.50	60	.55	.50
University Control Public: 1986-1987	84	.65	.48	56	.52	.50	60	.55	.50

Table A-3 (Continued)

Variable	Chemistry N	Chemistry Mean	Chemistry S.D.	English N	English Mean	English S.D.	Psychology N	Psychology Mean	Psychology S.D.
University: Size									
Number of Faculty (FT): 1970-1971				51	653.33	366.13			
Number of Faculty (FT): 1973-1974				51	665.51	397.11			
Number of Faculty (FT): 1976-1977	76	781.13	367.99	48	711.33	347.38	50	638.62	322.70
Number of Faculty (FT): 1979-1980	79	785.65	372.77	54	707.11	331.57	56	653.54	339.21
Number of Faculty (FT): 1982-1983	85	800.65	370.58	56	717.04	329.26	59	638.39	347.24
Number of Faculty (FT): 1985-1986	85	802.76	366.70	56	718.95	330.24	56	685.79	315.05
Number of Students (FTE): 1974-1975	85	14,280.89	7,937.30	56	12,591.62	7,404.72	59	11,045.61	7,168.72
Number of Students (FTE): 1978-1979	84	15,197.99	7,419.74	56	13,274.34	7,267.10	60	11,665.87	7,031.73
Number of Students (FTE): 1982-1983	83	16,152.80	7,867.10	55	13,952.04	7,624.92	59	12,459.05	7,558.62
Number of Students (FTE): 1986-1987	85	16,027.09	7,846.09	57	13,870.35	7,545.60	62	12,400.79	7,482.70
Number of Graduate Students (FTE): 1974-1975	85	2,459.49	1,817.41	56	2,431.77	1,682.47	59	2,089.00	1,696.78
Number of Graduate Students (FTE): 1978-1979	84	2,469.68	1,684.58	56	2,436.46	1,703.27	59	2,102.49	1,646.16
Number of Graduate Students (FTE): 1982-1983	83	2,589.69	1,637.81	55	2,370.80	1,504.98	58	2,199.33	1,607.55
Number of Graduate Students (FTE): 1986-1987	85	2,755.08	1,875.46	57	2,564.95	1,680.54	61	2,332.34	1,811.98
Research Doctorate University: 1973				57	.65	.48			
Research Doctorate University: 1976	85	.66	.48	57	.67	.48	59	.58	.50

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Table A-3 (Continued)

Variable	Chemistry N	Chemistry Mean	Chemistry S.D.	English N	English Mean	English S.D.	Psychology N	Psychology Mean	Psychology S.D.
Research Doctorate University: 1987	86	.70	.46	57	.65	.48	59	.58	.50
University: Faculty Quality									
Average Faculty Compensation (FT): 1969-1970				51	519.27	62.48			
Average Faculty Compensation (FT): 1973-1974				51	588.29	66.52			
Average Faculty Compensation (FT): 1976-1977	76	682.59	64.75	49	691.92	64.27	50	692.18	62.99
Average Faculty Compensation (FT): 1979-1980	79	843.33	82.58	54	848.15	80.87	56	853.36	83.37
Average Faculty Compensation (FT): 1982-1983	85	1,102.13	124.80	56	1,108.96	111.01	57	1,107.32	118.10
Average Faculty Compensation (FT): 1985-1986	85	1,343.76	160.77	56	1,362.61	139.63	56	1,362.64	143.27
University: Learning Resources									
Percentage of Graduate Students (FTE): 1974	85	17.82	10.11	56	21.11	13.72	59	25.58	23.30
Percentage of Graduate Students (FTE): 1978	84	17.15	10.61	56	20.32	14.63	59	24.54	23.59
Percentage of Graduate Students (FTE): 1982	83	17.18	10.28	55	19.42	14.04	58	25.21	24.25

Table A-3 (Continued)

Variable	Chemistry N	Chemistry Mean	Chemistry S.D.	English N	English Mean	English S.D.	Psychology N	Psychology Mean	Psychology S.D.
Percentage of Graduate Students (FTE): 1986	85	18.07	10.64	57	20.30	14.00	61	24.77	23.23
Ratio of Volumes to Students (FTE): 1976-1977	43	135.47	121.96	27	160.59	134.01	21	195.06	150.21
Ratio of Volumes to Students (FTE): 1979-1980	53	151.78	128.05	33	176.95	139.96	29	197.36	151.31
Ratio of Volumes to Students (FTE): 1982-1983	51	137.95	106.60	31	159.89	113.72	28	202.58	145.63
Ratio of Volumes to Students (FTE): 1985-1987	49	152.44	106.25	27	176.00	112.14	26	218.21	144.57
Ratio of Current Periodicals to Students (FTE): 1976-1977	43	1.46	1.30	27	1.73	1.37	21	2.08	1.61
Ratio of Current Periodicals to Students (FTE): 1979-1980	53	1.62	1.15	33	1.85	1.18	29	2.03	1.32
Ratio of Current Periodicals to Students (FTE): 1982-1983	51	1.52	1.10	31	1.68	1.12	28	2.06	1.45
Ratio of Current Periodicals to Students (FTE): 1985-1987	49	1.60	1.06	27	1.73	1.02	26	2.12	1.40
University: Financial Assistance									
Nonresident Tuition: 1971-1972				49	1,771.37	746.26			
Nonresident Tuition: 1974-1975	66	2,016.83	896.63	44	2,190.70	872.09	41	2,258.02	900.20
Nonresident Tuition: 1978-1979	64	2,596.02	1,262.48	39	3,032.92	1,200.15	41	3,101.71	1,293.90

Table A-3 (Continued)

Variable	Chemistry N	Chemistry Mean	Chemistry S.D.	English N	English Mean	English S.D.	Psychology N	Psychology Mean	Psychology S.D.
Nonresident Tuition: 1982-1983	52	3,816.21	2,185.67	32	4,488.41	2,076.08	35	4,847.66	2,372.11
Nonresident Tuition: 1986-1987	50	4,939.62	2,643.24	37	6,409.19	3,150.78	30	6,307.17	3,076.31

Table A-4

Institutional Characteristics Available for Selected Disciplines: Means and Standard Deviations for Chemistry, English, and Psychology Departments

Variable	Chemistry N	Chemistry Mean	Chemistry S.D.	English N	English Mean	English S.D.	Psychology N	Psychology Mean	Psychology S.D.
Department: Size									
Common Field: 1974-1975	72	.94	.23				45	.67	.48
Common Field: 1978-1979	82	.87	.34				55	.65	.48
Common Field: 1982-1983	81	.90	.30				55	.65	.48
Common Field: 1986-1987	76	.91	.29				46	.61	.49
Department: Selectivity									
Masters Students Admitted: 1986-1987							51	.22	.42
Number of Admissions Requirements of High Importance: 1973-1974							52	.98	.83
Number of Admissions Requirements of High Importance: 1977-1978							59	1.90	.99
Number of Admissions Requirements of High Importance: 1982-1983							59	1.76	.84
Number of Admissions Requirements of High Importance: 1986-1987							49	2.12	1.03
Number of Kinds of Undergraduate Courses Required: 1973-1974							60	1.42	1.50
Number of Kinds of Undergraduate Courses Required: 1977-1978							59	1.05	1.28

Table A-4 (Continued)

Variable	Chemistry N	Chemistry Mean	Chemistry S.D.	English N	English Mean	English S.D.	Psychology N	Psychology Mean	Psychology S.D.
Number of Kinds of Undergraduate Courses Required: 1981-1982							59	.98	1.25
Number of Kinds of Undergraduate Courses Required: 1986-1987							54	.93	1.27
Department: Requirements									
Number of Requirements for Doctorate: 1973-1974							58	2.76	.76
Number of Requirements for Doctorate: 1977-1978							59	2.58	.70
Number of Requirements for Doctorate: 1981-1982							59	2.05	.80
Number of Requirements for Doctorate: 1986-1987							53	2.06	.84
Number of Credit Hours for Doctorate: 1986				47	56.49	19.93			
Department: Faculty Availability									
Faculty Classroom Hours per Week				32	8.03	1.79	43	6.42	2.42
Ratio of Undergraduate Majors Graduating to Faculty (FT)				35	2.26	1.30	36	4.06	2.49
Percentage of Instructors and Assistant Professors (FT Tenure Track)				36	18.79	10.72	36	18.88	13.75

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Table A-4 (Continued)

Variable	Chemistry N	Chemistry Mean	Chemistry S.D.	English N	English Mean	English S.D.	Psychology N	Psychology Mean	Psychology S.D.
Department: Faculty Quality									
Number of Articles Attributed to Program: 1978-1979	86	77.91	57.09				61	13.90	11.42
Percentage of Faculty With Articles, 1978-1980							60	65.92	17.58
Influence of Articles Attributed to Program: 1978-1979	86	49.84	9.66				61	49.80	10.48
Percentage of Faculty with Doctorates (FT Tenure Track)				34	92.92	7.63	36	99.20	2.37
Department: Learning Resources									
Year Founded[a]							60	1,934.17	26.23
Years Awarding Doctorate: 1986				52	48.42	29.54			
Ratio of Clerical Staff (FTE) to Faculty (FT): 1984-1985							42	.39	.38
Ratio of Instructional and Research Equipment Budget to Students (FTE): 1984-1985							40	466.82	1,053.87
Department: Research Resources									
Percentage of Faculty with Research Grants: 1978-1980	86	49.22	21.70				60	23.80	18.91

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Table A-4 (Continued)

Variable	Chemistry N	Chemistry Mean	Chemistry S.D.	English N	English Mean	English S.D.	Psychology N	Psychology Mean	Psychology S.D.
Amount of Research and Development Expenditures for Discipline: 1974-1975	53	1,063.74	762.11				36	481.19	485.76
Amount of Research and Development Expenditures for Discipline: 1977-1978	56	1,403.11	1,097.81				31	670.35	623.28
Amount of Research and Development Expenditures for Discipline: 1980-1981	59	2,193.31	1,596.52				34	944.59	959.65
Amount of Research and Development Expenditures for Discipline: 1983-1984	59	3,068.78	1,927.24				34	1,204.29	1,054.11
Amount of Research and Development Expenditures for Discipline: 1986-1987	59	4,269.88	2,628.92				36	1,371.64	1,243.72
Ratio of Research Support Staff (FTE) to Faculty (FT): 1984-1985							39	.14	.19
Ratio of External Research Funds to Faculty (FT): 1985							40	14,338.43	12,452.07
Department: Financial Assistance									
Admit Doctoral Students Without Support: 1986-1987							44	.70	.46
Maximum Support Offered Doctoral Students: 1986-1987							44	12,244.70	5,390.31

Table A-4 (Continued)

Variable	Chemistry N	Chemistry Mean	Chemistry S.D.	English N	English Mean	English S.D.	Psychology N	Psychology Mean	Psychology S.D.
Average Assistantship Hours: 1973-1974							35	36.49	6.20
Average Assistantship Hours: 1977-1978							32	34.50	6.45
Average Assistantship Hours: 1981-1982							22	34.09	8.89
Average Assistantship Hours: 1986-1987							44	33.43	8.10
Average Assistantship Stipend: 1986-1987							45	9,961.93	3,123.06